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The economic impact of sanctions for the EU and Russia : the Ukrainian crisis case

Morad Bali

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THÈSE

Pour obtenir le grade de

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Communauté Université Grenoble Alpes et
l'Université d'État d'Économie de Saint-Pétersbourg**

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préparée au sein du **Laboratoire CESICE (Centre d'études sur
la sécurité internationale et les coopérations européennes)** et
du **Département de Statistiques-Econométrie de l'Université
d'Etat d'Economie de Saint-Pétersbourg**

dans les **Écoles Doctorales Sciences Economiques (UGA)** et
Université d'Etat d'Economie de Saint-Pétersbourg

IMPACT ECONOMIQUE DES SANCTIONS POUR L'UE ET LA RUSSIE : LE CAS DE LA CRISE UKRAINIENNE

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THE ECONOMIC IMPACT OF SANCTIONS FOR THE EU AND RUSSIA: THE UKRAINIAN CRISIS CASE

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IMPACT ÉCONOMIQUE DES SANCTIONS POUR L'UE ET LA RUSSIE : LE CAS DE LA CRISE UKRAINIENNE

ABSTRACT

Cette thèse examine les effets économiques des mesures coercitives internationales mises en œuvre par l'Union européenne et par la Russie dans le cadre de la crise ukrainienne. Après avoir étudié les articles de recherche les plus pertinents de la littérature qui étudie les sanctions économiques, l'auteur utilise des statistiques descriptives pour évaluer les conséquences des sanctions économiques sur le commerce russo-européen. Les résultats révèlent que tant les exportations russes vers l'UE que les exportations européennes vers la Russie ont diminué de manière significative après le début du conflit économique. Ce fait est surprenant puisque plupart de ces flux commerciaux ne sont ni directement ni indirectement visés par les sanctions. Une analyse économétrique robuste est donc menée afin d'isoler le seul impact des sanctions et de déterminer si la diminution observée du commerce russo-européen est due aux sanctions. À cette fin, l'auteur a dû créer un indice sanction qui simule la mise en œuvre de mesures économiques coercitives dans des modèles économétriques. Ainsi, 342 modèles structurels à vecteur autorégressif par pays (CSVAR) sont lancés, utilisant l'indice sanction comme variable causale. Les effets des sanctions économiques sur le commerce et la croissance économique sont observés pour la Russie et les vingt-huit économies européennes. Il semble que les sanctions n'affectent pas directement le commerce et la croissance économique. Néanmoins, les résultats de la décomposition de la variance des erreurs de prévision montrent des preuves solides de l'effet d'entraînement des sanctions ("*sanction ripple effect*"), défini comme les perturbations économiques résultant de la détérioration générale du climat des affaires due à un conflit économique, même dans les secteurs qui ne sont pas la cible des mesures coercitives.

Mots clés : Russie, Union européenne, crise ukrainienne, sanctions économiques, SVAR

Thesis advisors: Natalia BOUROVA, Eric BRUNAT, Fanny COULOMB

ECONOMIC IMPACT OF SANCTIONS FOR THE EU AND RUSSIA: THE UKRAINIAN CRISIS CASE

ABSTRACT

This thesis examines the economic effects of international coercive measures implemented by the European Union and by Russia during the Ukrainian Crisis. After having reviewed the most relevant papers from the literature that study economic sanctions, the author uses descriptive statistics to assess consequences of economic punishment on Russian-European trade. Results reveal that both Russian exports to the EU and European exports to Russia decreased significantly after the economic conflict started. It is astounding, as most of these trade flows are neither directly nor indirectly targeted by sanctions. Consequently, it was necessary to conduct a robust econometric analysis in order to isolate the lone impact of sanctions, and to find out if the observed decrease of Russian-European trade was due to sanctions. To that end, the author had to create a sanction index that would simulate the implementation of economic coercive measures in econometric models. Thereafter, 342 country structural vector autoregression models (CSVAR) were run, using the sanction index as causal variable. The effect of economic punishment on trade and economic growth was observed for Russia and the twenty-eight European economies. It appears that sanctions do not affect trade and economic growth directly. Nonetheless, the results of forecast error variance decomposition show robust evidence of the *sanction ripple effect*, defined as economic disruptions emerging from the overall business climate deterioration due to an economic conflict, even within sectors that are not covered by any coercive measures.

Key words: Russia, European Union, Ukrainian crisis, economic sanctions, SVAR.

« Faut-il s'armer, faire la guerre, ressaisir par la force, des faveurs qui vous échappent par la pente des choses ? Non, assurément ; je ne crois pas qu'il y ait un seul commerce étranger dont les bénéfices annuels payent l'intérêt des frais d'une guerre entreprise pour le conserver. [...] Que si la nation qu'on a coutume d'approvisionner, vous prive tout à coup, par humeur, par folie, de ses communications lucratives... je n'ai rien à dire de cela : c'est un des inconvénients du commerce extérieur. Pour le coup on déclarera la guerre... fort bien : à ce malheur, on en ajoutera un autre ».

Jean-Baptiste SAY
Traité d'Economie Politique
Livre Premier
Chapitre XLI de l'édition I
[Say \(1803\)](#)

“Shall we use weapons, wage war, try to recapture by force, favours that inevitably slip through our hands? No, certainly not; I do not think there is a single foreign business whose annual profits pay the interest on the costs of a war undertaken to keep it. [...] That if the nation you are accustomed to supply, suddenly, out of temper, out of madness, deprives you of its lucrative communications... I have nothing to say about this: this is one of the disadvantages of foreign trade. For this reason war will be declared... very well: to this misfortune, another one will be added...”

Jean-Baptiste SAY
A Treatise on Political Economy
Book I
Chapter XLI, first edition
[Say \(1803\)](#)

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In French Algeria, my grandfather was an experienced and well-known Berber merchant in his area until the Algerian War of Independence forced him to give up on everything and to set up in mainland France. Thereupon, he had to work as coal miner for a while to feed his family and to save enough money to start over his trading activity. My uncles learned everything from him and decided to become traders. The first time I helped them in their business was at the age of seven, and I was already fascinated by everything that was surrounding it. I needed to understand what was determining prices, why people wanted to buy certain products while refusing to buy others, et cetera. Without even knowing it at the time, I was fascinated by economics. Years later, I began my studies in this science, knowing that I would have to work hard to reach the PhD level, and to become an economist. It seems that I am about to achieve my initial goal, and it is essential to mention those who contributed to it.

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Introduction

Since spring 2014, the European Union has set restrictive measures against the Russian Federation. These measures are a diplomatic answer to the annexation of Crimea (March 2014), and to Russian actions in eastern Ukraine in the context of the War in Donbass. A few days after the establishment of European measures, Russia published a list of reciprocal sanctions. Moreover, in the beginning of August 2014, Russia started an embargo on imports of agricultural products from countries/entities that had adopted economic sanctions against the Russian Federation. These actions did not evolve much –except for their own renewal and prolongation, leaving room for the study of their effects. The explicit goal of this research is not to determine whether there are winners or losers in this economic conflict, even if outcomes of this dissertation shall allow any careful reader to draw its own conclusions. Nevertheless, this doctoral thesis aims at measuring economic implications that can be directly attributed to aforementioned sanctions. Thus, the problematic of this thesis is “Are economic sanctions imposed in the context of the Ukrainian crisis effective?” The effectiveness is here defined as the ability of the sanction sender to inflict economic pressure to his target.

Irrespective of possible economic impacts, at the time of writing, sanctions implemented in the Ukrainian crisis context do not work. Indeed, none of the involved players has changed its stance or own expectations regarding opponents’ actions. On the one hand, the Republic of Crimea is still a subject of the Russian Federation and the situation in Eastern Ukraine remains unstable. On the other hand, the international community has not yielded to Russian countermeasures and embargo. Unavoidably, it is clear that both Western and Eastern measures are a diplomatic failure. For this very reason, it becomes even more important to observe the economic consequences of this crushing defeat. This doctoral work being only a small contribution to what needs to be done, resulting costs shall be measured as precisely as possible by fellow economists. It is essential to bring to light what was taken from nations, particularly as policy-makers made their decisions at the drop of a hat. One might cling to the hope that exposing economic consequences of sanctions could, eventually, contribute to avoid any further reiteration of such devilishly flawed methods.

1. Literature Review

This literature review is composed of two main parts. Papers studying economic sanctions have been gathered in the first section. It answers to questions such as, “What is an economic sanction? Which type exist? What characterises their effectiveness? How do they work? Do they work?” *et cetera*. The second part focuses on the Russian rouble determinants. Which papers have been studying this question and how did they do it? This is useful to know in order to differentiate effects that are due to the depreciation of the Russian currency, from those led by international coercive measures.

1.1 From the Study of Sanctions

International economic sanctions are one of States' preferred tools when it comes to subjecting another country to their objectives. Economic sanctions literature seems enormous at first glance. Indeed, there are good grounds for considering that almost all cases since the beginning of the 20th century have been studied. Yet, what exactly has been examined? Is it really as thoroughgoing as it seems? To begin, it is necessary to define what an international economic sanction is. Yet, the very definition of what is or what is not an economic sanction is a source of conflicts in the literature. [Doxey \(1980\)](#) defined sanctions as measures lifted by an international entity constitutionally authorized to do so, in order to force a target country to change its policy so that it's no longer in conflicts with international laws. [George et al. \(1994\)](#), for whom sanctions are an alternative to military strategy, can supplement this overly restrictive definition. Thus, *coercive diplomacy* is defined as:

“[...] efforts to persuade an opponent to stop or reverse an action”
(George et al. (1994), p. 7).

It is clear here that the notion of conflict with international laws disappears. Moreover, they add:

“(coercive diplomacy) calls for using just enough force of an appropriate kind –if force is used at all- to demonstrate one’s resolve to protect well-defined interests as well as the credibility of one’s determination to use

more force if necessary [...] The coercive strategy necessarily includes the signaling, bargaining, and negotiating that are built into the conceptualization and conduct of any military alerts, deployments, or actions –features that are not found or are of secondary interest in traditional military strategy” (George et al. (1994), p. 10).

It means that if coercive diplomatic measures are a tool used to demonstrate one’s will to defend precise interests –such as the territorial integrity of a country, it also used to ascertain the credibility to use military force if necessary. That being said, it is crystal-clear that this strategy has a reporting and negotiation character – since military measures are not defined as a coercive measure.

[Hufbauer et al. \(1990a, 1990b\)](#) consider military measures as a form of international economic sanction, even if it is not clearly stated in their definition of economic sanctions:

“(economic sanctions) the deliberate, government-inspired withdrawal, or threat of withdrawal, of customary trade or financial relations”
([Hufbauer et al. \(1990a, 1990b\)](#), p. 2).

Later, they precise that there are three types of sanctions:

“There are three main ways in which a sender country tries to inflict costs on its target: by limiting exports, by restricting imports, and by impeding finance, including the reduction of aid”
([Hufbauer et al. \(1990a, 1990b\)](#), p. 36).

From this basis, it is vital to understand that their work represents the cornerstone of empirical literature on economic sanctions. They built a gigantic sanctions database that is quite impressive since it covers all cases of coercive measures from 1914 to 1990 (115 cases in total). Their key result is that economic sanctions over the studied period have a success rate of 33%. Nonetheless, a massive earthquake occurred with the paper of [Pape \(1997\)](#), which is a strong and robust criticism of [Hufbauer et al. \(1990a, 1990b\)](#). Indeed, [Pape \(1997\)](#) disagrees with their definition of sanctions. To him, it is necessary to clearly distinguish economic sanctions from military measures. Moreover, he states that sanctions’ success can be granted only if:

1. The target complies with a significant proportion of the issuer’s requests.

2. The target complied after the establishment of economic sanctions.
3. Sanctions are the only credible explanation to the target's compliance.

Based on these considerations, [Pape \(1997\)](#) made a critical review of the work of [Hufbauer et al. \(1990a, 1990b\)](#). As a result, he found that among the 40 cases of economic sanctions reported as successful in [Hufbauer et al. \(1990a, 1990b\)](#), 32 include errors, 5 are valid, and 4 are undetermined successes. It therefore reduces the sanctions' success rate from 34% to 5%. It is worth noting that [Elliott \(1998\)](#) responded to [Pape \(1997\)](#) regarding what is, and what is not an economic sanction. It is somehow once again a conflict of definition, that is therefore important since it ascertains when a sanction is successful or not. However, [Pape \(1998\)](#) himself argued back in "Why Economic Sanctions Still Do Not Work" and contradicted [Elliott \(1998\)](#)'s arguments. Although it is difficult to recognise false from true, the fact is that the database of [Hufbauer et al. \(1990a, 1990b\)](#) has already been modified twice¹. Finally, it is also interesting to mention that [Drury \(1998\)](#) also provide a strong critique of [Hufbauer et al. \(1990a, 1990b\)](#) in "Revisiting Economic Sanctions Reconsidered". Indeed, by reanalysing their data using ordered logit estimation, and by adding hypotheses from the literature, [Drury \(1998\)](#) highlight the lack of significance of their variables' relationship. According to him, the accuracy and importance of their results shall be questioned. These "conflicts" of definition are crucial since they change the method used in the study of international economic sanctions. They even affect the construction of databases or econometric models. Thus, to avoid any bias due to the choice of definition in this thesis, it has been decided to create a Sanction Index² that will simulate international coercive measures.

1.1.1 Several Shades of Sanctions

The intuitive element with regard to sanctions' effectiveness is that *strong sanctions* are more effective than *weak sanctions*. This argument was put forward very early in [Doxey \(1980\)](#). The author explains that sanctions' effectiveness and impact depend on the issuer's objective. Thus, the stronger the objective, the higher

¹ It was done in 2007 by the authors themselves, and later by the Peterson Institute of International Economics.

² See Chapter III for further details.

economic pressure is required. Hence, this economic pressure determines the degree of effectiveness of sanctions. It also defines either a sanction is *strong* (high economic pressure applied) or *weak* (low economic pressure enforced). Professor Doxey gives assurance that in the case of *strong sanctions*, the sanctioned entity will tend to submit to the issuer's will. Thirty years later, [Whang \(2010\)](#) consolidates this thesis with a quantitative study based on game theory (through a Bargaining Game). He concludes:

“Strong sanctions significantly enhance the predicted probability of compliance, whereas weak sanctions do not” ([Whang \(2010\)](#), p. 572).

Another empirical evidence of Professor Doxey's thesis lies in [Hufbauer et al. \(2003\)](#). They use [Feenstra et al. \(2001\)](#) gravity model to investigate the impact of economic sanctions on U.S. trade. To be precise, their work centre around a gravity model and not a basic multiple linear regression model as used in [Hufbauer et al. \(1990a, 1990b\)](#). Authors find that *extensive sanctions* have a real effect on trade between two countries –reducing it by 90%, while *moderate* or *limited sanctions* have almost no effect. They define³ *limited sanctions* as minor trade, financial, or travel sanctions; it would also be possible to mention *weak sanctions* here. Additionally, *moderate sanctions* are described⁴ as broader sanctions, including five or more restrictions that were described in the definition of *limited sanctions*. Lastly, they mention that *extensive sanctions* are:

“comprehensive trade and financial sanctions such as those in place against Cuba, Iraq, Iran, and North Korea”
([Hufbauer et al. \(2003\)](#), p. 3).

It is clear that there isn't a great difference between their definitions, and the principle that the economic pressure determines the type of sanction (*weak*,

³ “This category includes up to four of the following restrictions: reduction or suspension of economic aid; reduction or suspension of military aid; export restrictions on arms or limited dual-use technologies; prohibition of credits or credit guarantees by the U.S. Export-Import Bank, Overseas Private Investment Corporation, Commodity Credit Corporation, or U.S. Trade and Development Agency; objections to loans from international financial institutions (e.g. World Bank); travel bans or visa restrictions; bans on the export or import of one or two goods; and diplomatic rebuffs.” (Hufbauer and Oegg, 2003, p. 3).

⁴ “These are broader trade or financial sanctions, with five or more of the restrictions that would otherwise be classified as limited. Moderate sanctions also include more severe financial sanctions such as investment banks or asset freezes and export restrictions that go beyond defense items or selective goods.” (Hufbauer and Oegg, 2003, p. 3).

moderate, strong). For instance, they come across the fact that sanctions' effectiveness diminishes over time:

“Finally, it should be recognised that the longer sanctions are in place, the greater the opportunity for both exports and imports to carve new channels” (Hufbauer et al. (2003), p. 13).

It should be noted that their results change drastically, depending on the method that they use. Indeed, they find a reduction in exports of \$4,600,000,000 in 1995 and \$4,800,000,000 in 1999 with the model-based method, while judgemental results expose a reduction in exports of \$9,300,000,000 billion in 1995 and \$9,100,000,000 billion in 1999. Nevertheless, it seems that their findings are robust since another paper published the same year is on the same line. Indeed, [Caruso \(2003\)](#) focuses on sanctions' impact on international trade. This work is focusing on 49 countries that were targeted by American sanctions over 1960-2000, inclusive. The author corroborates previous results with a gravity model –even if his definition⁵ of *moderate* and *extensive sanctions* is somehow simpler:

“[...] extensive and comprehensive sanctions have a large negative impact on bilateral trade, while this is not the case for limited and moderate sanctions” (Caruso (2003), p. 26).

Meanwhile, [Morgan and Schwebach \(1997\)](#) indirectly work on the notion of profitability⁶ of sanctions through a costs comparison. It is another approach, but the core-logic remains the same –sanctions' effectiveness depends on the economic pressure (or incurred costs). That being said, authors compare the issuer's incurred costs due to the application of sanctions, to the target's costs. They conclude that: (i) high costs for the target increases sanctions' effectiveness, also see [Dashti-Gibson et al. \(1997\)](#); (ii) high incurred costs for the issuer reduces sanctions' effectiveness. It seems quite interesting to merge these results with the context of the Ukrainian crisis. Assumptions would be that: (a) Russian costs due to international sanctions are low, while international costs due to Russian countermeasures are high; (b) incurred costs of European sanctions are high

⁵ “For simplicity, partial trade restrictions and financial sanctions will be included in ‘moderate’, and extensive trade and financial restrictions will be considered ‘extensive’” ([Caruso \(2003\)](#), p. 14).

⁶ This precise notion is not used in their work, yet it seems perfectly appropriate to use it.

whereas incurred costs of Russian countermeasures are low. The expected outcome would be a low effectiveness of international sanctions against Russia, combined with high effectiveness of Russian coercive measures. All of this being hypothetical, it will be checked later in this thesis. However, high incurred costs for the sender are also demonstrated in [Yang et al. \(2004\)](#), where the economic impact of U.S. sanctions on the U.S. economy is examined. They use an enhanced gravity model, and panel data. They show that U.S. sanctions have a significant negative impact on U.S. trade:

“Third, U.S. comprehensive economic sanctions have a significant negative impact on U.S. bilateral trade, exports, and imports, with target countries subject to these sanctions” ([Yang et al. \(2004\)](#), p. 58).

It is important to note that they find estimated export losses for the U.S. economy that are quite close to those found in [Hufbauer et al. \(1997\)](#), even if their databases are different.

This subsection will end with [Galtung \(1967\)](#) and [Eland \(2018\)](#)⁷ who are not in line with Professor Doxey's thought. Indeed, for these two authors, sanctions' effectiveness does not depend on the increase in economic pressure that they inflict. [Galtung \(1967\)](#) highlights the idea that economic sanctions against a nation tend to produce internal *political integration* within the country. The nation feels economic pressure as external interference in the nation's affairs, which tends to create *political integration* instead of *political disintegration*. He also indirectly mentions the “unfairness” of sanctions:

“Sanctions against collectivities will always affect the just together with the unjust, since collective sanctions correspond to a philosophy of collective guilt [...] sanctions are just another way of acting out the billiard-ball image of nations-that is, nations as undifferentiated wholes” ([Galtung \(1967\)](#), p. 409).

This naturally results in the strengthening of the targeted country:

“[...] even under a totally effective blockade a country may continue to run on its internal resources, and these resources (economic, social,

⁷ Firstly published in 1995.

moral, political) may be strengthened rather than weakened by the sanctions [...] to feel that the rest of the world is “ganging up” on one may serve as a very effective and hardening stimulus, supporting paranoid and psychopathic tendencies as well as more salutary forces”
([Galtung \(1967\)](#), p. 411).

However, Professor Galtung does not exclude the fact that sanctions might be effective if:

“For reasons due to the structure of the internal economy of the target nation as well as to its trade structure, the damage wrought or anticipated may appear so much more frightening than the renunciation of its goals that capitulation or compromise may be the result” ([Galtung \(1967\)](#), p. 410).

Even if it is not related to the topic of this subsection, this point is interesting for our work. Indeed, it reveals that sanctions might work if the target’s economic structure has a very specific configuration that would increase the outcome of economic coercive measures. This suggests that the issuer would have to study the economy of its target, in order to set up adapted sanctions. Yet, doing so would admittedly require time and funding. Consequently, it would create a robust *sanction dilemma* for the issuer who has to either lose the *immediacy*⁸ of sanctions and risk to jeopardise its own international image⁹ in front of allies –since doing nothing can be seen as a form of complicity, or responding immediately with coercive measures that would certainly fail to reach their goal. On the other hand, [Eland \(2018\)](#) specify that if *total* sanctions are likely to lead to *political integration*, *partial* or *limited* sanctions can lead to disintegration (since political opposition will tend to act against the government). Moreover, the author states that the more effectively the sanctioned country controls information, the stronger *political integration* will be. In fact, if the government is able to control what people know about sanctions, then there is a good chance that they will stand next to their leaders. Finally, [Green \(1983\)](#) directly answers [Galtung \(1967\)](#), highlighting the fact that Professor Galtung do not integrate countries’ *natural endowments*. For

⁸ “A basic point in sanction theory is immediacy; whether the sanctions take the form of reward or of punishment, they should ideally follow the actions to be rewarded or punished so closely that a clear connection is established. If there is a considerable delay, the learning effect may be considerably reduced.” (Galtung (1967), 1967, p. 409).

⁹ “When military action is impossible for one reason or another, and when doing nothing is seen as tantamount to complicity, then something has to be done to express morality, something that at least serves as a clear signal to everyone that what the receiving nation has done is disapproved of.” (Galtung (1967), pp. 411-412).

example, in the case of Rhodesia that imported many agro-food products, he states that:

“self-reinforcement cannot grow food, although, when there is food, people can be, even in the face of an implacable foe, unified and integrated” (Green (1983), pp. 82–83).

1.1.2 Scattered Sanctions and Effectiveness

In line with [Doxey \(1980\)](#), [Morgan and Schwebach \(1997\)](#) explain that if sanctions' effectiveness depends on the use of either *strong* or *weak sanctions*, it is also a function of the target type. If the target is scattered, so will the economic pressure, making sanctions less effective than if all the pressure is concentrated into a single sector or group of activities. They go further by explaining that in the case of *scattered sanctions*, the receiver will have the opportunity to resist longer. [Neuenkirch and Neumeier \(2015\)](#) go further stating that sanctions' effectiveness depends on the number of issuing countries. The article uses a database that compiles all the United Nations and the United States of America sanctions that occurred between 1976 and 2012. They compare effects of sanctions on GDP of targeted countries, and conclude that sanctions from a group of countries are more effective:

“Our results suggest, first, that sanctions imposed by the United Nations have a significant influence on economic growth. On average, the imposition of UN sanctions decreases the target state's annual real per capita GDP growth rate by more than 2 pp. [...] the adverse effect of US sanctions on real GDP growth is much smaller and of less duration than that of UN sanctions” (Neuenkirch and Neumeier (2015), p. 29).

It means that in the Ukrainian crisis case, international sanctions against Russia should apply a higher economic pressure than Russian response since a large group of countries targeted the Russian Federation. Finally, the article also highlights the fact that the longer sanctions last, the less effective they are, as stated in [Hufbauer et al. \(2003\)](#). Sanctions' effectiveness is therefore a decreasing function of time. This point is one of the major hypotheses used to build our Sanction Index.

“An investigation of the dynamics of the sanction effects reveals that the detrimental influence decreases over time and becomes insignificant

after 10 years [...] Our findings suggest that real GDP growth declines only when economic sanctions are actually imposed, indicating that our results are not driven by omitted factors that coincide with UN sanction episodes” (Neuenkirch and Neumeier (2015), pp. 29-30).

1.1.3 Circumvention Strategies & Third-Country Effect

What could be more effective to avoid sanctions’ effects than simply dodging sanctions? This is the idea behind *circumvention strategies* and the so-called *third-country effect*. For instance, [Green \(1983\)](#) mentions *circumvention strategies* as leaks in economic sanctions. These strategies being used by national companies in order to avoid sanctions. That is why it seems to him that except if sanctions are applied “hermetically”, they have low chances of being effective. This idea is enlarged by [Rodman \(1995\)](#) who indirectly supplements the thesis of [Morgan and Schwebach \(1997\)](#) regarding governments’ inability to angle economic pressure toward a single sector. Professor Rodman states that this failure is due to the presence of multinational firms from the sanction-sender country. These firms will likely choose to maximise profits instead of applying sanctions, illustrating perfectly the case of *circumvention strategies*:

“As a result, MNCs could, in the words of one scholar, “arbitrage’ their regulatory position” to maximise corporate profits, often at the expense of the diplomatic preferences of the home state”
([Rodman \(1995\)](#), p. 106).

Besides, [Rodman \(1995\)](#) explains that sanctions’ effectiveness hinge on the issuer ability to anticipate reactions of both the targeted country and multinational firms. Mostly as they are legally and physically capable of circumventing directives of the issuing country. The effectiveness of sanctions therefore also depends on the issuer's ability to bend multinational companies to its will. To do this, Professor Rodman suggests that the government can impose additional costs on companies, for example, in the case of Nicaragua:

“The Reagan administration inhibited investment and lending less through direct control than through other actions that intensified Managua's foreign exchange crisis” ([Rodman \(1995\)](#), p. 133).

They can also create an uncertain environment, particularly for banks; see cases of Nicaragua and South Africa. Finally, they can remove services to companies in order to increase the internal risk taken by them. In the case of Libya and South Africa, for example, the federal government has threatened to eliminate export assistance, tax negotiations, access to information about these countries, and government contracts.

Regarding the *third-country effect*, [Bonetti \(1998\)](#) makes an interesting contribution by highlighting the role of countries' international political structure. He explains that the presence of a third-party helping the target tends to rout sanctions:

“First, the presence of significant third-party assistance to the target is the most powerful way in which failure can be generated”
(Bonetti (1998), p. 811).

In addition, he points out that:

“The circumstances conducive to total rather than marginal success of economic sanctions are the use of sanctions in pursuit of an objective which is not classified as ‘modest’” *(Bonetti (1998), p. 812).*

These findings are essential since they perfectly match the Ukrainian crisis case. Firstly, Belarus¹⁰ clearly played and probably still plays –at the time of writing- a third-party role:

“It's all Belarusian, Belarusian oysters, Belarusian mandarin. Unfortunately the system is unclear in this respect, so these products are allowed to enter the country.” *Alexei Nemeryuk¹¹, head of Moscow's Department of Trade and Services.*

Secondly, one must recognise that the loss of a federal subject is inconceivable for the Russian Federation, even if annexation conditions can certainly be discussed. In addition, it is clear that pre-sanction relations between the Russian Federation and most of its Western counterpart were neutral, if not good. [Caruso \(2003\)](#) covers the *third-country effect* from another perspective. The key result of his article is

¹⁰ <http://www.ctv.by/en/belarus-to-create-new-joint-ventures-to-supply-foods-to-russia>

¹¹ <https://www.freshplaza.com/article/2138109/greek-bypass-for-boycott/>

that third-party countries –not issuing sanctions nor receiving them– may still experience a decrease in trade:

“Other countries than the sender could experience a trade disruption induced by a unilateral economic punishment”
([Caruso \(2003\)](#), 2003, p. 26).

In contrast, this effect is studied in [Yang et al. \(2004\)](#) where its outcome is positive:

“In some cases, we found that these sanctions have actually promoted trade between these countries and the EU or Japan. This is a clear indication of third-country effect”, ([Yang et al. \(2004\)](#), p. 59).

The *third-country effect* also appears in [Jones and Whitworth \(2014\)](#) –although it is not quoted as such– since authors shows that sanctions have also changed the behaviour of Russian trade partners not directly involved in the economic war. These countries tend to reduce their trade with the issuing countries. They explain that:

“The challenge would then be to reassure Russia and other countries that their participation in a global economy structured around American- and European-dominated financial institutions did not carry with it an unacceptable, implicit threat”
([Jones and Whitworth \(2014\)](#), p. 27).

Moreover, the conclusion of this article is that sanctions intensify divisions of the global financial market infrastructure. Since it is related to the relative assistance to the balance of payments, to the development assistance, and to post-trade activity. As a result, global financial markets might be less efficient and effective. In [Hellquist \(2016\)](#), the *third-country effect* is examined from another perspective. The focus is on the alignment of countries uninvolved in the economic conflict between Russia and the rest of the world. It is a clear demonstration that some countries were “invited” to align on sanctions of the European Union against Russia. It seems that this pattern is not new and that the EU has been doing it at least since 1996¹² through the Common Foreign and Security Policy. This alignment has been and still is a kind of blackmail towards candidate states

¹² Table 1, pp. 9-10 in [Hellquist \(2016\)](#).

(Albania, Montenegro, Serbia, *et cetera*.) Reciprocally, Russia tried to enrol Commonwealth of Independent States countries in the implementation of the embargo. Authors reveal that these tries failed for both players as neither the EU nor Russia managed to impose their will.

“With only Norway and Albania fully committing to EU sanctions, alignment has reached an all-time low. Thereby, a two-decade long legacy of impressive alignment numbers has been broken.”
([Hellquist \(2016\)](#), p. 16).

“None of the Eurasian Economic Union (EEU) members (Kazakhstan, Belarus, Armenia, Kyrgyzstan) has joined Russian countersanctions [Russell \(2016\)](#)” in ([Hellquist \(2016\)](#), p. 18).

One of the reasons brought forward by authors in order to explain the failure of these alignment attempts is the fact that countries have much more to lose if they conform to coercive measures, than if they do not. Besides, it seems that the geographical proximity influences decisions:

“third countries are less inclined to side with sanctions against countries that are geographically close; likely because these countries are considered close also in other respects” ([Hellquist \(2016\)](#), p. 11).

[Early \(2009\)](#) even shows that closest allies of the sender state are more likely to bust its sanctions. It also supports the idea that when economic health is at stake, it is highly unlikely that a country will incline with sanctions (as it happened in the Ukrainian crisis case):

“[...] the most influential predictors of sanctions-busting amongst third parties are factors that senders can do little about: the third party’s GDP, trade openness, and its having a strong pre-existing commercial relationship with the target” ([Early \(2009\)](#), pp. 67-68).

These results are even more valuable once bound to the findings of [McLean and Whang \(2010\)](#). Indeed, they are the first to have empirically demonstrated that:

“the sanctioner is considerably more likely to succeed in obtaining concessions from its target when the target’s largest trading partners support the sanctioner’s coercive action and decrease trade exchanges with the target.” ([McLean and Whang \(2010\)](#), pp. 444-445).

In other words, it means that in order to succeed, the sender has to convince the target's largest trading partner to align. It seems highly unlikely to happen since consequent pre-existing trade relationship between countries lead to sanction-busting, see [Early \(2009\)](#). Finally, [Peksen and Peterson \(2016\)](#) highlight a very interesting fact. To them, the ability to evade sanctions' economic costs –through third-party countries– partly influences the sender's decision to implement sanctions. Even if it seems quite rational and logical, the Ukrainian crisis case demonstrates that this finding can't be taken for granted.

1.1.4 When Friendly Fire Increase Efficiency

One would be curious to know if sanctions' outcome depends on whether the sender and the issuer are allies or enemies. The idea behind this is that sanctions' effectiveness is relative to potential losses due to eventual changes in diplomatic relations between countries. Professor Galtung seems to be the first to mention this idea, as he does not exclude the fact that sanctions might be effective if:

“the rupture of generally smooth relations is perceived as a worse threat than some short-run lack of gratification” ([Galtung \(1967\)](#), p. 410).

It could explain why international sanctions against the Russian Federation were so easily adopted since most issuers were not in neutral relations with Russia. Besides, it might explain why several countries refused to set up international sanctions against the Russian Federation: tarnishing its own international image –by refusing to raise sanctions– comes at a lower cost than turning off great economic relations with the Russian Federation. This is particularly true for Eurasian trader partners of Russia. However, empirical evidence of Professor Galtung findings will arrive later:

“the presence of either cordial or neutral pre-sanction relations between sender and target” ([Bonetti \(1998\)](#), p. 812).

“On the other hand, sanctions against an ally put economic and political strain on the sender state if the allied target opts for resistance. Knowing that sanctions failures place a burden on the sender when the target is an ally, the allied sender is more cautious about initiating sanctions” ([Whang \(2010\)](#), p. 564).

[Whang \(2010\)](#) asserts that the relationship between the issuer and the target determines the outcome of sanctions. He explains that if the two actors are not allies, the target will probably not consider the issuing country's willingness to pursue coercive measures until the end. Thus, threats of increasing and repeating economic sanctions are unable to bring the sanctioned country to its knees, and sanctions have low chance of success. Furthermore, [Whang \(2010\)](#) explains that issuing sanctions against an allied country would probably encumber the sender. Again, if it is hard to say that European countries were allies of Russia (politically), it seems legitimate to assume that they were not enemies of Russia. Thus, it is clear that they had neutral if not friendly economic relations. That being the case, there were no great surprises to expect –if we believe previous findings– regarding the outcome of international economic sanctions against Russia.

1.1.5 *Against the Odds*

Most of the literature studied in the previous section considers that economic sanctions are effective. Even if their degree of effectiveness varies depending on authors, it is clear that they still work. Nonetheless, there are also authors who spent time demonstrating that sanctions do not work. In order to get back to international sanctions against Russia, it is possible to mention [Nureev and Petrakov \(2016\)](#), which highlights the realisation of the *Giffen paradox*¹³. They reveal that while sanctions led to an increase in prices of food, electronic goods, and durable goods in Russia, household consumption increased. They are using the example of *Apple Inc.* goods, but also of intra-Russian tourism:

“Despite the rapid rise in prices for the company's products (price of products rose by 25% on Nov. 25, by 35% on December 22), sales growth comprised 80%” ([Nureev and Petrakov \(2016\)](#), p. 7).

To them, sanctions led to the rouble depreciation (making international tourism costlier for Russians). This assumption can be called into question. Indeed, [Dreger et al. \(2016\)](#) focused on the comparative impact between oil prices fall and

¹³ The fact that the consumption of some goods can increase even though their price is rising.

international sanctions on the Russian rouble depreciation. They demonstrate that the Russian rouble depreciation is mostly due to oil prices fall, and not to sanctions:

“The analysis is based on cointegrated VAR models, where fundamental long-run relationships are implicitly embedded. The results indicate that the bulk of the depreciation is caused by the decline of oil prices”
([Dreger et al. \(2016\)](#), p. 26).

Earlier, [Pape \(1997\)](#) also mentioned that it is difficult to measure the impact of economic sanctions if factors that are exogenous to sanctions but endogenous to the economic situation of the targeted country, occur simultaneously. Especially if these factors are economically unmeasurable, as it is the case with military measures or threat of interventions. He says:

“In addition, economic sanctions or the threat of sanctions and force or the threat of force are very often employed simultaneously, making it especially important to distinguish which type of pressure was responsible for a particular concession” ([Pape \(1997\)](#), p. 106).

Despite this, [Nureev and Petrakov \(2016\)](#) argue that the fact is that the Russian rouble depreciated, and Russians preferred to visit southern Russia for their holidays, stimulating regional economies:

“Foreign trips of Russian citizens in 2014 decreased by 15% compared to 2013 (from 54.1 million to 45.9 million) and the demand for domestic tourism in 2014 increased by 30-40%, this trend continued in 2015”
([Nureev and Petrakov \(2016\)](#), 2016, p. 9).

They also add that the Russian rouble depreciation made Russia cheaper for foreigners, increasing intra-Russian tourism by the same token. Still in the context of the Ukrainian crisis, [Jones and Whitworth \(2014\)](#) focus on the unintended consequences of sanctions against Russia. They show that international sanctions have encouraged Russia to seek new partners, in order to be less dependent on Western ones. This finding leads us to a new path to explore, where we would wonder what would be the after-sanctions trade structure. Indeed, it seems that changes due to sanctions are a part of what could be called “*prevention policy*”, since it allows Russia to safeguard her imports structure by the choice of reliable trade partners (because they are less likely to commit to future sanctions). Finally,

[Brunat \(2016\)](#) highlights the fact that sanctions might have a higher cost for the European Union than for the Russian Federation. Knowing that it is the EU which started this economic conflict, such assumption means that there could be a real blowback of measures of the EU against European countries.

“Escalation of mutual sanctions between Western countries and Russia and tensions are worsening the situation. In case of a long economic war or an embargo against Russia (which necessarily implies a negative spiral of penalties in both directions), the cost would be paid mainly by the Europeans (especially with tensions on the price of energy that could ultimately result as well as the measures directly affecting agricultural exports and European agrofood).”

([Brunat \(2016\)](#), p. 250).

1.1.6 When Sanctions are Hidden

In another approach, [Olson \(1979\)](#) makes a distinction between *declared* and *hidden* sanctions. He states that *hidden* sanctions are more effective:

“Much of the previous literature on international economic sanctions has focused on highly public attempts at coercion; the unanimous conclusion has been that such measures have failed [...] they tend to lead to political integration (even if there are serious economic effects) rather than disintegration, and are therefore self-defeating”

([Olson \(1979\)](#), pp. 492-493).

Indeed, the idea brought forward is that if the targeted country's population is not aware of economic sanctions, Galtung's effect cannot happen and economic pressure leads to *political disintegration*. On the other hand, there is even a good chance that the population will consider that the deterioration in economic health results from government's poor management. This brings us back to the role of information control, see [Galtung \(1967\)](#) and [Eland \(2018\)](#)¹⁴. Olson considers, however, that if the choice is made on *declared* sanctions, then the necessary condition for their success is that they are *strong*. He is therefore in line with Professor Doxey's thinking. Nevertheless, if Olson recognises that Galtung is

¹⁴ Firstly published in 1995.

right¹⁵, he disagrees about the fact that a country's vulnerability relies only on *concentration*¹⁶. Indeed, he explains that:

“[...] *classic international trade is no longer as important as public and private capital flows, technology transfers, and intra-corporate trade* [...] *they lend themselves more to manipulation and subtle sanctioning*”
([Olson \(1979\)](#), p. 493).

Finally, an interesting idea brought forward by Olson is that the ability of economic sanctions to spread to political effects depends on *relative deprivation*¹⁷. Indeed, he states that:

“[...] *the political effects of economic coercion will depend upon which groups or classes are the most intensely affected, and on the relative importance of these groups or classes in the support structure of the authorities and the regime*” ([Olson \(1979\)](#), p. 493).

It is true that this notion is not directly related to the quantification of economic sanctions effects on the economy. However, it is still interesting regarding political outcomes of sanctions. Since the use of *political disintegration* to destabilise countries became a real tool of economic war, one must bow down before others' will or disappear. However, [Olson \(1975\)](#) is not the only one to mention *hidden sanctions*. Indeed, [Orlova \(2016\)](#) focuses on sanctions' impact on the Russian banking sector. She observes three forms of sanctions. The first is when sanctions apply to an entire sector (as tourism in the Ukrainian case). The second concerns sanctions targeting entities named in a given list (as Russian public companies targeted by sanctions). Finally, the third form regards *soft sanctions*, and seems to be the most dangerous. Indeed, the author illustrates this with the fact that –in the Ukrainian crisis– international banks were no longer able to automate payment to Russia. As international sanctions included a list of companies and persons under sanctions, international banks must check on a case-by-case basis if the payee is not on the list of sanctions. Otherwise, they may themselves be

¹⁵ “In essence, Galtung is right, but his view of the world's political economy is dated” (Olson, 1979, p. 477).

¹⁶ “the more a country's economy depends on one product and the more its exports and imports are concentrated on one trade partner, the more vulnerable is the country” (Olson, 1979, p. 477).

¹⁷ “Relative deprivation is defined as actors' perceptions of discrepancy between their value expectations (the goods and conditions of the life to which they believe they are justifiably entitled) and their value capabilities (the amounts of those goods and conditions that they think they are able to get and keep)” (Gurr, 1968, p. 1104).

sanctioned. This considerably increases payment times, and has the effect of slowing down the market. [Orlova \(2016\)](#) demonstrates this very clearly by analysing the evolution of fluctuations in the interbank market of the dollar:

“Up to that point, the dollar exchange turnover of the interbank market was \$1–2 billion per day, but under the influence of the sanctions it dropped to \$100 million per day. Interest rates for overnight loans, which were 0.1–0.2 percent, grew to 1–1.5 percent by September”
(Orlova (2016), p. 206)

1.2 To the Russian Rouble Determinants

This part might appear off-topic since it doesn't directly treat economic sanctions. Yet, this section is an essential stage of this thesis. Indeed, since the Russian rouble collapsed in the third quarter of 2014 and until the second quarter of 2015 (right after the establishment of international sanctions against Russia), one might want to know if economic sanctions are responsible. The idea behind this would be that if economic sanctions did lead to the Russian Rouble depreciation, all occurred effects of the decrease in the value of the rouble shall thereupon be considered as sanctions' effects. Implications of such an assumption would, of course, be able to substantially influence the results of this study. Despite the fact that [Dreger et al. \(2016\)](#) focused on this precise matter, it is believed that the new sanction index created in this thesis will provide interesting results and breakthroughs.

Over the recent period, the Russian rouble has been subjected to numerous speculations and fantasies. The currency of the Russian Federation made the news in an unprecedented fashion. Indeed, the Ukrainian crisis marked a turning point in the currency's behaviour. Whereas it was possible to buy one U.S. dollar (more or less) with 30 roubles in January 2014, it was necessary to give twice as many to get one dollar a year later. The media didn't need more to justify this depreciation with international sanctions, swearing that the Russian economy was collapsing under Western pressure. Yet, even if it is true that sanctions started roughly at the same period, several other exogenous factors also happened. Among them, capital flight and oil price fall were great candidates to explain the rouble

weakening. However, it is also important to bear in mind that the Russian currency depends on endogenous factors such as M2 aggregate, Central Bank key interest rates, *et cetera*.

The Russian rouble is the currency of the Russian Federation. It was introduced in 1992 to replace the Soviet rouble, itself introduced in 1923, see [Samotesov et al. \(2018\)](#). It is also the first currency to have been decimalised under Tsar Peter the Great in 1704 with one rouble being equal to one hundred kopeks. Moreover, after the British pound, the rouble is the oldest national currency, and has been used in Russian territories since the 13th century, see [Foo \(2019\)](#). Nowadays, one might like to know that the Russian currency is also used in Donetsk People's Republic, Luhansk People's Republic, Republic of Abkhazia and Republic of South Ossetia. The aim of this paper is to examine the available literature regarding the Russian currency's determinants, in order to provide an up-to-date synthesis. To do so, the first part of this work will study research papers using linear regression models, while the second part will focus on vector-based models.

1.2.1 Linear Regression Models

In this part, we will try to find common points and differences between papers studying the rouble, comparing both data and results of the literature.

1.2.1.1 Data

Six papers using linear regression models have been reviewed, among which some interesting trends can be gleaned. Most of them integrate oil prices, revealing the importance of Brent fluctuations. The only paper that isn't using oil prices is the one of [Kataranova \(2010\)](#), since it uses gas and focuses mostly on consumer price index and GDP. It seems that half papers are using real effective exchange rate, while others are using nominal exchange rate. Finally, if consumer price index is integrated in most papers, M2 aggregate is used in only two of them. Surprisingly, sanctions aren't present in every model, even in most recent ones. However, it seems that linear regression models studying the Russian currency are using four variables in their calculations on average. See Table 0 for further details.

TABLE 0
DIFFERENT VARIABLES USED IN LINEAR REGRESSION MODELS

<i>Author(s)</i>	<i>Model</i>	<i>P/\$</i>	<i>Oil</i>	<i>Interest rate</i>	<i>Sanctions</i>	<i>CPI</i>	<i>GDP</i>	<i>M2</i>
Benedictow et al. (2013)	OLS	REER	Y	Money Market	N	Y	Y	N
Blokhina et al. (2016)	OLS	REER	Y	Y	<i>Dummy</i>	Y	N	N
Bykau et al. (2016)	Linear	REER	Y	N	N	Y	N	N
Kataranova (2010)	Distributed lag models	NOMINAL	N	N	N	Y	REAL	Y
Tyll et al. (2018)	ADL	Y	Y	N	N	N	N	Y
Urbanovsky (2015)	Autoregressive	NOMINAL	Y	MIOIR	N	N	N	N

Notes: “Y” stands for “yes” and means that the variable is used in the paper, while “N” stands for “no” and means that the variable is not integrated in the model. In [Urbanovsky \(2015\)](#) these variables are also integrated: gas, gold, stocks, euro against U.S. dollar exchange rate. In [Kataranova \(2010\)](#), regulated rates charged for electric power, gas, and railroad transportation are also integrated.

1.2.1.2 Results

In light of the above, [Urbanovsky \(2015\)](#) is using most variables in his model (seven in total). For which results? Firstly, a decline in oil price leads to the Russian rouble depreciation. Additionally, it also seems that a U.S. dollar appreciation triggers a rouble depreciation. Finally, price of natural gas doesn't have an explanatory power, and can be excluded as a determinant of the Russian currency. More recently, the paper of [Blokhina et al. \(2016\)](#) is using a total of five variables, in which sanctions are set as a dummy variable. A new key result is that inflation in the domestic market leads to a devaluation of the rouble. Moreover, because of sanctions and the fact that Russian companies had debt in USD, the demand for USD has grown in Russia, leading to a depreciation of the rouble (from 35 rub/USD to 65 rub/USD). It should be noted that it follows findings of [Urbanovsky \(2015\)](#). Finally, another important result is that a rise in Central Bank key interest rates increases the Rouble demand and strengthens it. It mostly increases the offer of foreign currency and reduces the dollar cost. In another fashion, [Benedictow et al. \(2013\)](#) are also using four variables in their model. They are among the two papers of this section integrating the GDP in their calculations. Their results show that a lower oil price leads to a real depreciation of the rouble in addition to slowing down economic growth. Reversely, they find that a high oil price leads to a nominal appreciation of the rouble, and to higher inflation.

On the basis of a seven variables model, [Kataranova \(2010\)](#) found interesting results regarding the relationship between consumer price index and Russian rouble. Oppositely to [Benedictow et al. \(2013\)](#), it seems that an appreciation of the Russian currency leads to a decrease of inflation, and *vice versa*. Thus, a 1% appreciation of the rouble leads to a 0.1% decrease of inflation. Yet, a 1% depreciation of the rouble brings an increase of inflation of 0.2%. In other words, consumer price index responds more readily to a depreciation than to an appreciation of the Russian currency. Besides, if the model is run without the monetary supply variable, the estimated exchange rate coefficient decreases. Moreover, a stimulating monetary policy causes a drop in the Russian rouble. Meaning that monetary policy is endogenous in relation to the rouble, as demonstrated by previous studies, see [Esanov et al. \(2005\)](#). Using a three variables model, [Bykau et al. \(2016\)](#) get interested in effects induced by the switch to a floating exchange rate of rouble in November 2015. They found that this switch has softened the negative effect of oil price variations. Indeed, they state that the rouble became less sensitive to a decrease in oil price. More interestingly, they explain that the influence of endogenous factors on exchange rate of rouble is increasing with the decline of oil price. Finally, regarding the consumer price index, they suggest that an oil price below \$10-15 per barrel could be critical for the Russian economy, triggering hyperinflation. The last paper that has been reviewed is the one of [Tyll et al. \(2018\)](#), it is also a model based on three variables. They aspire to get interested in the impact of sanctions on the Russian economy, but it is not clear how they simulate sanctions in their models. However, they confirm previous results since they find that a decrease in oil prices of \$1 depreciate the Russian currency by \$0.58 in average.

1.2.2 Vector-Based Models (VEC, VAR)

In this section, papers using vector-based models are considered. The great majority of articles reviewed are using Vector Autoregression models (VAR). These models have solid forecasting capabilities, and can easily be tested for Granger non-causality. However, the major advantage that can be found in these models – in comparison with linear regression ones – is related to their specification. Indeed,

researchers can somehow get rid of the theory bias, as they don't need to assess which variables of the model are endogenous or exogenous since they are all endogenous. Some would say that the ability of VAR to avoid economic theory and economic assumptions is a handicap; but in a world full of uncertainty, more credence could be put in the fact that these models can free ourselves from subjective and coercive political constraints. It doesn't matter if the researcher is either liberal or socialist, since his own personal beliefs are less likely to influence his model construction, and thence his results. However, since it is also important to compare results depending on the model used, this section will focus on nine papers, using two to seven variables.

TABLE 1
DIFFERENT VARIABLES USED IN VECTOR-BASED MODELS

<i>Author(s)</i>	<i>Model</i>	<i>RUB/USD</i>	<i>Oil</i>	<i>Interest rate</i>	<i>sanctions</i>	<i>CPI</i>	<i>GDP</i>	<i>M2</i>
Beck et al. (2007)	VECM	REER	Y	N	N	N	REAL	Y
Dreger et al. (2016)	VAR	NOMINAL	Y	RUONIA	<i>Index</i>	N	N	N
Granville and Mallick (2006)	VAR	NOMINAL	N	REFRATEM	N	Y	N	Y
Izatov (2015)	VAR	REER	Y	N	N	Y	IPI	N
Ito (2010)	VAR	REER	Y	N	N	Y	REAL	Y
Mironov and Petronevich (2015)	VEC	REER	Y	N	N	N	N	N
Rautava (2004)	VAR & VECM	REER	Y	N	N	N	Y	Y
Tuzova and Qayum (2016)	VAR	REER	Y	N	<i>Dummy</i>	Y	REAL	N
Yu and Wu (2017)	VAR	Y	Y	Y	N	Y	Y	Y

Notes: "Y" stands for "yes" and means that the variable is used in the paper, while "N" stands for "no" and means that the variable is not integrated in their model. In [Tuzova and Qayum \(2016\)](#) these variables are also integrated: Real household consumption expenditure, Real government consumption expenditure, Real investment, Real exports and real imports. In [Mironov and Petronevich \(2015\)](#), physical volume of exported oil, differential in labour productivity of Russia vs its trade partners, government expenditures, and net international reserves are also included.

1.2.2.1 Data

Nine papers using vector-based models have been reviewed. This is three more than the previous section. Here again, they are all integrating oil prices, except the

paper of [Granville and Mallick \(2006\)](#). On the one hand, gross domestic product is used in most papers as much as consumer price index (CPI) and M2 aggregate (used in five articles). On the other hand, interest rate can be found in three papers, and sanctions in only two –even if five papers use data covering the implementation of economic sanctions. Unlike linear regression models, more than half of the studied literature is using real effective exchange rate. Finally, half of these papers use more than four variables.

1.2.2.2 Results

It seems rational to begin with [Yu and Wu \(2017\)](#) since their paper has the most complete model with six variables in total. Their study focuses on the relationship between Russian rouble and energy prices. They find that when international energy price index rises, exchange rate appreciates. Moreover, they state that 41.1% of the Russian currency fluctuation is due to changes in energy prices. This relation is in the same vein as papers of previous section. However, they also find that 26% of the rouble fluctuation is explained by weighted annual interest rates. It strengthens the fact that interest rates are an important variable to study the Russian exchange rate. Another paper using a quite complete VAR model –10 variables based– is the one of [Tuzova and Qayum \(2016\)](#). From the rouble perspective, there is nothing new under the sun as their Impulse-Response figures confirm that in the case of a drop in oil prices, the Russian currency increases in the short-term. Meaning that the rouble would depreciate in reaction to a decrease in oil prices. In the same way, [Dreger et al. \(2016\)](#) also found that the bulk of rouble's depreciation is caused by a decline in oil prices, and *vice versa*. Using a four variables SVAR, they also found that an increase of Russian interbank rate for overnight loans (RUONIA) leads to an appreciation of the Russian currency, while a depreciation of the rouble causes an increase of RUONIA. Moreover, sanctions in their paper are simulated with a composite index, and results of impulse response functions reveal that the Russian rouble is quite robust against sanctions.

[Mironov and Petronevich \(2015\)](#) confirmed that eruptive flows of export revenues (Oil Price) result in a significant appreciation of the real effective exchange rate.

In addition, they put forward that an increase in export revenues by 1% causes a 0.2% appreciation of the rouble. This means that it is highly likely that the Russian currency is serving as a channel through which oil prices can affect the economic structure. Interestingly, [Izatov \(2015\)](#) exposes the fact that in the short-term, economic development also plays a major role in the determination of the real effective exchange rate. Thus, it seems that a 10% increase (decrease) of the Russian rouble is related to a 0.5% appreciation (depreciation) of the economic activity in the long-term. [Granville and Mallick \(2006\)](#) made some useful discoveries. Based on a four variables VAR model, they expose that an interest rate increase triggers a consequent appreciation of the nominal exchange rate. Furthermore, if it is true that the currency is significantly affecting consumer price index (Laspeyres index) in the short-run, the converse is not.

Finally, three papers have results that lean against the wind. [Rautava \(2004\)](#) – based on four variables VAR&VECM models– states, “Movements of the real exchange rate are not affected by changes in oil prices”, which is quite surprising if we remember previous results of the literature. Following this paper and using a four variables VECM model, [Beck et al. \(2007\)](#) find several relevant results. Indeed, impulse response functions (IRF) reveal that if the rouble appreciates in the short-term after a rise in oil prices, the Russian currency seems to depreciate in the long-term in response to the same shock. This uncommon long-term relationship might be explained by the fact that confidence intervals of their IRF witness a lack of significance in the long-term. However, they also explain that the appreciation of the exchange rate is related to an increase in government consumption (through its positive impact on inflation). This mean that government consumption might be an interesting variable to integrate in models studying Russian rouble determinants. Finally, [Ito \(2010\)](#) found –using a five variables VAR model– that a 1% increase (decrease) in oil prices leads to a 0.17% depreciation (appreciation) of the Russian currency, both in the short-term and long-term. It is once again quite surprising since the vast majority of papers previously studied provide different results.

1.3 Conclusion

Two sets of papers were studied in this literature review. The first one focused on articles using linear regression models, while the second one explored vector-based publications. It is clear for most authors that a decline in oil prices results in a depreciation of the Russian rouble, and *vice versa*. Thus, on the basis of results previously examined, which variables should be considered in order to build a reliable econometric model? First of all, Central Bank interest rates since their increase provoke an appreciation of the rouble, see [Granville and Mallick \(2006\)](#) and [Dreger et al. \(2016\)](#). Secondly, M2 monetary aggregate shall be integrated as control variable since monetary policy is endogenous in relation to the rouble. Thirdly, it is also interesting to integrate the Russian government spending as its increase leads to an appreciation of the exchange rate, see [Beck et al. \(2007\)](#). Concerning economic sanctions, they shall be integrated as a causal variable only.

Furthermore, the €/USD exchange rate is an interesting control variable to add. Indeed, as a reminder, [Urbanovsky \(2015\)](#) and [Blokhina et al. \(2016\)](#) found a causal relationship between an appreciation of the USD and a depreciation of the RUB; not to mention that a large part of the Russian economy is highly related to the American currency (debt in USD, foreign direct investments, *et cetera*). Finally, the integration of capital flight as a control variable should be encouraged. Indeed, capital flight, as it occurred during the Ukrainian crisis, can influence the Russian currency drastically, see [Anton \(2015\)](#). Strangely, it seems that authors reviewed during this work have almost all forgotten to integrate capital flight in their calculations. Whereas papers studying the relationship between capital flight and exchange rate are numerous, as [Calvo et al. \(1993\)](#) or [Ndou et al. \(2017\)](#) did. That being said, it is not necessary to add inflation in the econometric modelling since it has more chances to be influenced by the exchange rate than reversely, see [Benedictow et al. \(2013\)](#) and [Kataranova \(2010\)](#). Thus, it remains optional, except if the chosen database contains a period where the rouble has been devaluated. Some other variables are optional and can be set aside, such as gold, real household consumption expenditures, international reserves, *et cetera*.

To conclude, it would seem desirable to study determinants of the Russian currency with a Vector-Based model of seven variables. To be precise, a structural vector autoregression model would offer great possibilities with the support of impulse response functions. It would integrate Russian government spending, economic sanctions, Russian interbank rate for overnight loans, M2 monetary aggregate, €/USD exchange rate, capital flight, and, of course, the Russian rouble exchange rate. At the time of concluding this report and to our best knowledge, such a modelling has never been done before.

2. Chapters' Overview

As shown in the literature review, the study of economic sanctions is both complex and difficult. Factors influencing their effectiveness are many, and it seems to be hard to isolate what comes out of sanctions from other parameters. Economics is very complex by nature, and it is even more challenging to bind it to the study of a phenomenon that implies many interdependencies between countries and their economic parameters. If it is true that this thesis excludes many aspects, it shall still provide a real step forward for the overall study of economic sanctions. This section describes the three chapters that constitute this research. It provides an overall explanation and justification regarding choices that had to be made.

2.1 Chapter I - Socio-Economic Context and Primary Assessment of Sanctions Effects

The first section describes the context of the Ukrainian crisis. It reveals that this crisis is far from being a simple political crisis. Indeed, the reality is that many factors led to the Ukrainian revolution of 2014 and to the armed conflict in Eastern Ukraine. History, languages, ethnicity, economics, and territorial issues all played their part in this terrible outcome. However, this contextualisation had to be brief and concise as this thesis goal is not to provide deeply detailed explanations about reasons and motives that led to the Ukrainian crisis. The second section provides details regarding coercive measures of the European Union, and countermeasures of the Russian Federation. It was important to draw the legal outline of economic

punishment. Firstly, to know what has to be studied, and secondly in order to precisely identify what needs to be included in the Sanction Index (Chapter III). Section 3 offers an initial assessment of sanctions' effects. It summarises results of the most recent papers that precisely focus on the Ukrainian crisis case. To ease the analysis, these results have been sorted in three parts:

1. **Economic Effects:** regroups effects on GDP and on trade.
2. **Financial and Monetary Implications:** concerns changes related to the financial and monetary sphere.
3. **Oil Sector:** focuses on eventual effects on the oil industry.

These three categories follow sanctions' targets (as described in official texts), and eventual indirect effects of sanctions are excluded. For instance, papers treating of sociological and societal consequences of sanctions have not been reviewed. It is not because of a lack of interest, but principally because it is already a tremendous task to focus on macro-economical outcomes. Thence, it has been decided to provide a precise and deep analysis of a few essential areas; trying to examine everything would ineluctably lead to a lower level of detail, due to this thesis's time limitation. The fourth section –using descriptive statistics– examines changes in EU-Russia trade. It has been decided to focus on trade as it is the main target of sanctions. It is a comparison of trade trends before and during economic sanctions. To do so, 18 databases regrouping a total of 452 variables and 68 702 values have been used. From the widest angle, the EU is firstly studied as a whole. It is a picture of trade between the EU and Russia. What is the total value of traded goods? What is the trade structure? Then comes a subsection where the very precise question of under-embargo goods is studied. Did they really stop to be exported to Russia? Then comes the fifth section that is a country analysis. Trade before and during sanctions is still studied, but this time the ten greatest European exporters to Russia are isolated. Changes in trade with Russia are studied on the same basis as in Section 3, but this time through a country *per* country analysis. It has been decided to do so as these ten greatest exporters account for 80% of the EU trade with Russia.

Finally, the last section of this chapter studies third countries. More precisely, it focuses on gateway countries: those having a common border with both the European Union and Russia. Norway, Belarus and Ukraine are selected and the EU exports of under-embargo goods to these countries are examined. It is based on three database that regroups data of each sub-subsection of under-embargo product. The total number of variable is 13 050, for 1 670 400 values. Thus, results show that it is highly unlikely that goods were exported to Norway for re-exportation motives (to Russia). It is mostly explained by two facts: (i) the country fully committed to European sanctions –even though it is not a member of the EU; (ii) there is a clear geographical ground barrier regarding the common border between Russia and Norway. Surprisingly, Belarus isn't the main gateway country, and Ukraine actually does better. Indeed, the total increase of exports of under-embargo goods from the EU to Belarus is 317.4m€, while Belarus barely reaches 19.5 m€. These values are incredibly low in comparison to what the entire European Union lost after the implementation of the embargo (-15.63b€). Thus, even if one succeeds in demonstrating causality –it has not been achieved here, the use of gateway countries to circumvent the embargo remains minor.

2.2 Chapter II – Sanction Index Modelling

As shown in the literature review and in the first section of Chapter I, most papers studying the economic impact of international sanctions in the Ukrainian crisis case are doing it through a descriptive statistics approach. Yet, if doing so reveals correlations and helps to adopts assumptions, it is not sufficient to corroborate causality. Only Econometrics can help us in this quest. One has to create models that integrate coercive measures as a causal variable. But is it that simple? The literature demonstrated that it is a delicate task to achieve since there is no such thing as “sanction variable”. Consequently, authors have to create it if they wish to make economic coercive measures a reality in models. The first who tried to do this –to our best knowledge– are [Dreger et al. \(2016\)](#). However, their composite sanction index has several limitations, and it seemed useful to offer a different tool for this thesis's purposes. This new instrument is developed in Chapter II with the first section detailing the mathematical formalisation, and with the second one

that compares this new index to the one developed in [Dreger *et al.* \(2016\)](#) –using four country SVAR models in total. Results show that the new sanction index has a stronger explanatory power, and affects short-term Russian production variations sharper than its predecessor.

On its basis, it is now possible to simulate economic punishment in our calculations. Nevertheless, if it is true that this new tool is indeed a more sophisticated instrument to the study of sanctions' economic effects, it still has a major limitation. Thus, for the sake of transparency, our readers shall be aware that this index is based on one arbitrary choice: the value of the Alpha parameter. These values put a weight on coercive measures depending on their type (against individuals, against a company, *et cetera*), which means that they are the mathematical foundation of the composite index. Even though it might look as a bold way of doing things, one must remember that previous papers didn't do better if not worse. Hence, if the Alpha parameter is indeed based on arbitrary values, these values do not lack logic and rationality. They must be considered as part of a heuristic that pragmatically reflects the economic reality. Undoubtedly, the ideal manner would be to calculate these values through a trial and error approach. For example, one model would need to be run as much as possible ($+\infty$), and each time with new values for the Alpha parameter. Results of all models ran would then need to be compared to check if one configuration is statistically more significant than another. But make no mistake, this might be a very slippery slope as it implies to repeat such an approach for each model. That is, for the 342 models ran in Chapter III. However, this path has not been rejected only because it has a high cost in time, but also because it is far from certain that it would lead to major changes in our results –intuition goes against it.

2.3 Chapter III – Econometric Modelling & Results

This chapter offers a highly quantitative aspect. It begins with the reasons why Structural Vector Autoregression models are used in this thesis. The main explanation is that they allow us to catch contemporaneous correlations between variables. Thus, the variation of one variable can lead to changes in another

variable at a different period of time. Moreover, it is possible to isolate effects of a shock of one variable on others. This is essential if one wants to observe sanctions effects on countries' economies. Then, the author describes why country SVAR models are used instead of "normal" SVAR. Typically, using CSVAR provides better details and results are more accurate. Moreover, it allows us to compare involved players with each other; results are obtained within a similar framework and with identical variables. Thereafter, the author provides details regarding the precise econometric modelling that is used.

This chapter is divided in three subsections. The first one, "Trade and Sanctions: Countries of The European Union", studies trade between the EU and Russia. The emphasis is placed on the EU exports (for each European country) to Russia net of goods targeted by the Russian embargo, and net of arms and ammunition. By doing so, one is able to see if products out of the embargo's range are impacted by European measures against Russia. Variables used are exports to Russia, harmonised index of consumer prices, labour productivity, producer prices in industry, exchange rate of the considered country's currency against the Russian rouble, marginal lending key interest rate, real effective exchange rate, foreign income (Russian GDP) and the European sanction index. The second subsection, "Trade and Sanctions: Russia", focuses on Russian exports to the European Union. It is an attempt to know if exports are impacted by European coercive measures, even though they are not targeted by them. Once again, country SVAR models are used because the Russian Federation has one export flow for each country of the EU. Variables used are marginal lending key interest rate of the Russian Central Bank, consumer price index for Russia, producer price index in industry for Russia, Russia's exports to the EU, the sanction index, brent oil price, natural gas price, country's currency exchange rate against the Russian rouble, and foreign income (GDP of the concerned European country). Finally, the last subsection, "Economic Growth and Sanctions", examines the overall impact of sanctions on European economies and on the Russian Federation. The drill is identical to previous subsections, with GDP as variable of interest. The used variables are marginal lending key interest rate, foreign direct investment, real effective exchange rate, harmonised index of consumer prices, labour productivity (or labour force

participation for Russia), gross savings, government expenditure, gross domestic product, and the sanction index. An additional model is then run (for Russia), using Brent instead of Labour Force Participation. It makes sense since Russian exports (and thus economic growth) are highly dependent on oil prices.

The principle of parsimony is used to conduct models' robustness tests. Each model run is re-run in a four variables reduced form. Then, a very basic linear regression is conducted, as much as a Bayesian linear regression. Finally, a rolling-window analysis is conducted to assess the stability of our models over time. All robustness tests support results of their initial model. Thence, results lead us to the fact that it is not possible to state that European sanctions had a direct effect on products untargeted by the embargo and exported to Russia. This is also true for Russian exports to European countries. Nonetheless, there is a real and statistically significant evidence of the presence of the sanction ripple effect. Indeed, sanctions are able to explain a consequent share of unexplained variations of variables of interest. It is thus clear that sanctions resulted in economic disruptions in trade and economic activity.



Socio-Economic Context and Primary Assessment of Sanctions Effects

Abstract

This chapter is focusing on sanctions' economic effects from a descriptive statistics perspective. It starts with a contextualisation of the Ukrainian crisis, in order to remind how everything started. The second part describes what is behind European and Russian sanctions. The third section examines different reports and studies, which try to measure the effects of diplomatic coercive measures. After that, the fourth part of this chapter compares before-sanctions trade to during-sanctions trade between the European Union and Russia. The fifth section follows a similar logic as section 4, yet, it is a country *per* country analysis. Thence, countries of the EU are ranked into the ten greatest exporters to Russia. Finally, the last section focuses on potential third-party countries. This chapter will therefore be useful in order to set up several assumptions, which will be checked in Chapter III (econometric modelling and results).

1. Contextualisation

Located between Russia on its East, Belarus on its North, Poland, Slovakia, and Hungary on its West, and finally the Black Sea, Romania, Moldova, and Transnistria on its South, Ukraine is the border between Western and Eastern Europe. It is indeed the largest country between these two blocs, covering an area of 603,549 km² (576,604 km² without Crimea). Its population reaches 41,800,000 people¹⁸, excluding the Autonomous Republic of Crimea and the city of Sevastopol.

MAP I01
UKRAINE: THE BORDER BETWEEN THE EAST AND THE WEST



1.1 Historical Background

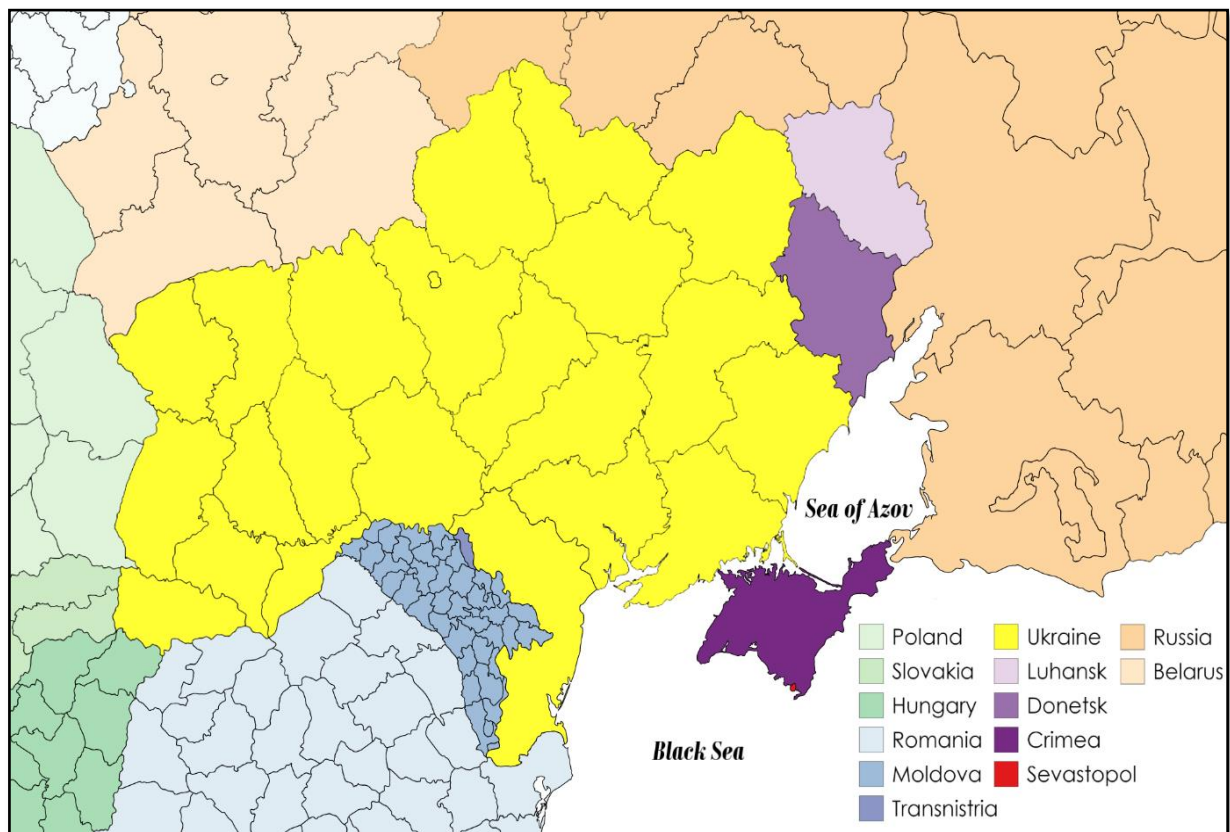
A significant fact is that the country –from about 879– was the centre of Kievan Rus, the first East Slavic state. If Kievan Rus disappeared during the 13th-century¹⁹ Mongol conquest, the Rus did not. In 1326, Ivan I of Moscow decided to offer a domain to the chief of the Russian Orthodox Church who had to leave Kiev's

¹⁸ As of March 1, 2020. http://database.ukrcensus.gov.ua/PXWEB2007/eng/news/op_popul_e.asp

¹⁹ Encyclopædia Britannica. <https://www.britannica.com/topic/Kyivan-Rus>

insecurity. Moscow became the spiritual capital of the Russian Orthodoxy²⁰. Thus, it seems coherent to consider Kiev, and actual Ukraine as the cradle of Slavic people. As a result, Kievan Rus is identified as the cultural ancestor of Belarus, Russia and naturally Ukraine. After²¹ having been a part of the Grand Duchy of Lithuania (from 1362) and then transferred to the Crown of the Kingdom of Poland (1569), Kiev came under control of the Russian Empire until its fall in 1917 and the proclamation of an independent Ukrainian state in January 1918. The independence of Ukraine was recognised by the Soviet government through the Treaty of Brest-Litovsk²² (March 3, 1918). This brief historical reminder is useful to have a better understanding of the relationship between Russia and Ukraine.

MAP I02
BORDERING COUNTRIES OF UKRAINE



1.2 Languages and Ethnicity

“After gaining independence by Ukraine, the Ukrainian language gained an opportunity to become a fully-fledged state language.”

²⁰ Pascal MARCHAND, Geopolitical Atlas of Russia, Editions Autrement publishing house, 2015, p. 12.

²¹ Encyclopædia Britannica, Kyiv. <https://www.britannica.com/place/Kyiv>

²² Encyclopædia Britannica, Treaties of Brest-Litovsk. <https://www.britannica.com/event/treaties-of-Brest-Litovsk>

However, territorially, it is spread unevenly, which is reflected in pronounced bilingualism and language bipolarity. These circumstances were among the main endogenic factors of the outbreak of an armed conflict in Eastern Ukraine and annexation of the Crimean Peninsula by the Russian Federation.”

([Matviyishyn and Michalski \(2017\)](#), p. 192).

According to its constitution, Ukrainian is the only official language of Ukraine. Additionally, results from the 2001 population census –see [Ukraiyny \(2001\)](#), reveal that in Ukraine, the part of those whose mother tongue is Ukrainian stands at 67.5% –others mostly have Russian as mother tongue. Yet, things are not that simple as these results are reversed in Eastern Ukraine, Crimea, and Sevastopol. Thus, the same census states that in Luhansk region, the part of those whose mother tongue is Russian reaches 68.8%. For Donetsk, the part of those whose mother tongue is Ukrainian is 5.9 pp lower (24.1%). Strangely, data regarding those whose mother tongue is Russian is missing²³. Similarly, no data are provided²⁴ regarding the language structure of the Autonomous Republic of Crimea. It is the same for Sevastopol²⁵. In addition, one can easily call the adopted methodology of such census into question. Thence, people questioned by officials about their native language could perfectly decide to comply with the state’s norm. It can be explained by the fact that Russian speakers in Ukraine do not have the same rights and entitlements as speakers of Ukrainian, see [Pavlenko \(2012\)](#). Besides, Ukrainian prevails in the sphere of public administration and education, see [Matviyishyn and Michalski \(2017\)](#). Finally, if it is true that there isn’t a real and consequent ethnic exclusion by the Ukrainian state towards Russians, there is still a perceived exclusion as a linguistically based extended group, as explained in [Fournier \(2002\)](#).

For these reasons, it has been necessary to explore internet archives and to use a research from the Kiev Center for Political Studies and Conflictology²⁶ to obtain data²⁷. Thus, Russian speakers in the Autonomous Republic of Crimea stand at

²³ http://2001.ukrcensus.gov.ua/eng/regions/reg_don/

²⁴ http://2001.ukrcensus.gov.ua/eng/regions/reg_crvn/

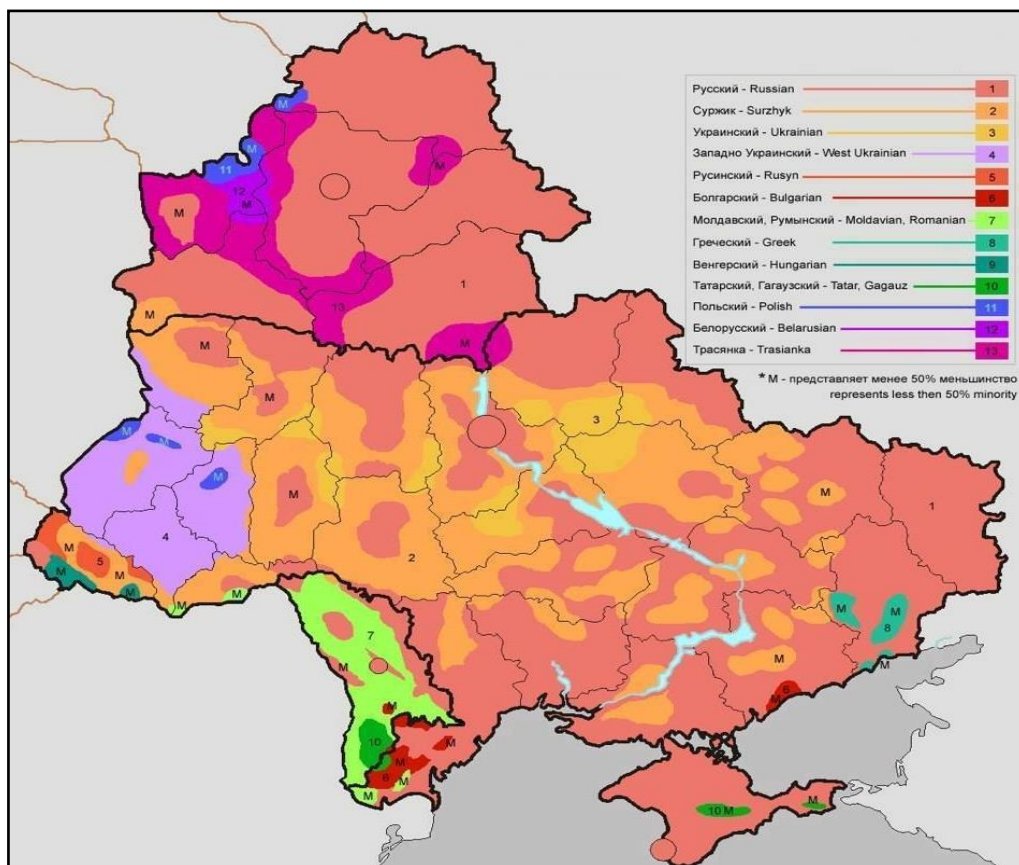
²⁵ http://2001.ukrcensus.gov.ua/eng/regions/reg_msev/

²⁶ <https://web.archive.org/web/20150403101945/http://www.analitik.org.ua/researches/archives/3dee44d0/41ecef0cad01e/>

²⁷ Initial study conducted by the Kiev International Institute of Sociology (2000 respondents were interviewed).

97%, 93% in Donetsk, 89% in Luhansk, 85% in Odessa, 81% in Zaporizhzhya and 74% in Kharkov. Consequently, it is clear that there is a real dichotomy regarding spoken languages. Indeed, most Ukrainian speakers are in Western Ukraine, while most Russian speakers are in the Eastern part of the country. This fact is supported by a study conducted by Kyiv National Linguistic University (2009) where the focus is on language spoken at home, see Map I03. The linguistic situation in Ukraine is a crucial element of national identity in Southern and Eastern Ukraine. In addition, national identity in these regions can explain the presence of strong lobbies for closer cultural, political, and economic ties with Russia. [Pirie \(1996\)](#) highlights the fact that Crimea was a proper place for separatism (because of the large proportion of individuals with a strictly Russian identity), while the Donbas seemed mainly interested in closer ties with Russia (as national identification is more mixed in this area). This intuition regarding Crimea was also highlighted in [Sasse \(2007\)](#) though the notion of *ethnopolitical mobilisation*.

MAP I03
LANGUAGES SPOKEN AT HOME IN UKRAINE, BELARUS, AND MOLDOVA



1.3 Territorial, Economic, and Historical Motives

“Language and ethnicity are not dominant issues in the Donbas; territorial and economic factors play a far more important role.”

(Kuzio (1996), p. 587).

[Sasse \(2007\)](#) also put forward the fact that languages are only one of the tools used by regional political actors in their rhetoric. Hence, the socioeconomic dimension seems to be a greater decisive regional concern. Seventeen years earlier, [Kuzio \(1996\)](#) also argued that territorial and economic factors were the dominant issues in the Donbas. The Donbas is certainly the most important coal source and industrial region of Ukraine, and maybe even of Eastern Europe (after Russia). It has estimated coal reserves of 60,000,000,000 tonnes of coal, see [Privalov \(2004\)](#). According to [Kirchner and Giucci \(2014\)](#), the Donbas contributed to 16% of Ukraine’s GDP in 2012 (12% for Donetsk, and 4% for Luhansk) and the region accounted for 25% of Ukraine’s sales of industrial products (19% for Donetsk, 6% for Luhansk). [Kirchner and Giucci \(2014\)](#) also show that if the average monthly wage in Donetsk (€3750) is higher than in the rest of Ukraine (€3250), the unemployment rate is also higher (by roughly 1 pp) than the national average (7.17%). Finally, the paper reveals that the Donbas accounts for 27% of Ukraine’s total exports. These facts have been one of the main arguments of separatists, arguing that Donbas people were not fully enjoying the overall wealth generated by the Donetsk Coal Basin. It has indeed a stronger place than the ethnopolitical element.

However, Donbas regions also received a lot from Ukraine through subsidies and subventions (assistance to families with children, socio-economic development, *et cetera*.) A detailed article²⁸ of “finance.ua” studied this question and brought clear numbers. In 2012, Donetsk received €10,900,000,000 while Luhansk obtained €5,300,000,000. There are also other channels such as payments related to the Pension Fund. Thus, an estimate states that Donetsk received more or less €9,600,000,000 while Luhansk got €4,200,000,000. There is also transfers made in order to support the Coal industry, such as the program “State support of coal

²⁸ <https://news.finance.ua/ru/news/-/298337/dotatsionnyj-donbass-dejstvitelno-li-region-kormit-ukrainu>

mining enterprises for partial coverage of costs at the cost of finished commodity coal products”²⁹. Thus, more than £14,000,000,000 were distributed in 2012 to support Donbas’ coal industry. To sum it all up, the Donbas received more than £44,000,000,000 but had to contribute to the state budget for £21,000,000,000. In conclusion, in 2012 the budget surplus reached £23,000,000,000. It makes the separatist argument of financial unfairness questionable.

In regards to Crimea, it is highly likely that arguments about the legality of the transfer of Crimea to the Ukrainian SSR in 1954 played a concrete role in the construction of Crimean separatism, see [Sasse \(2007\)](#). The donation of Crimean Oblast of the former Russian Soviet Federative Socialist Republic to the former Ukrainian Soviet Socialist Republic is attributed to Nikita Krushchev –as first secretary of the Communist Party of the Soviet Union. It seems that it was a symbolic gesture –a gift marking the celebration of the 300th anniversary of the Treaty of Pereyaslav that made Ukraine a part of the Tsardom of Russia, see [Marples and Duke \(1995\)](#). However, some state that there is a real issue³⁰ of constitutionality regarding Krushchev’s gesture. For instance, it seems³¹ that only 13 of the 27 members of the Supreme Council were present to the session that adopted the decision “unanimously”. Others state that this argument is a “fake from Russian mass media”, see [Zadorozhnyi \(2016\)](#). Having said that, it is hard to know what is true and what is fake, and this matter shall be left to historians. Be as it may, one can perfectly understand why this contentious issue has fuelled pro-Russian positions.

Finally, it is also important to highlight that the Holodomor is another source of animosities between ethnic Russians and ethnic Ukrainians. This famine killed from 6-7³² to 12 million³³ Ukrainians (mostly ethnic Ukrainians) between 1932 and 1933. One must understand that this famine has been seen as man-made by Joseph Stalin’s government, see [Mass \(2013\)](#), [Sabol \(2017\)](#) and [Stark \(2010\)](#). Even

²⁹ Государственная поддержка угледобывающих предприятий на частичное покрытие расходов по себестоимости готовой товарной угольной продукции

³⁰ https://www.pravdareport.com/history/107129-ussr_crimea_ukraine/

³¹ Ibid.

³² [Wheatcroft \(2001\)](#)

³³ Ukrainian Genocide Famine Foundation. <http://www.ukrainiangenocide.org/>

if some disagree (see [Furr \(2014\)](#)), it still hasn't been forgotten by many ethnic Ukrainians. It can also explain the Ukrainian collaboration with Nazi Germany, and how Barbarossa operation has been eased. Thus, while ethnic Russians of Eastern Ukraine mainly decided to join the Red Army, an entire Waffen SS division mostly composed of ethnic Ukrainians was created – *14. SS-Freiwilligen Division "Galizien"*. This historical background is also an important element to understand ethnic animosities and the Ukrainian crisis. Moreover, knowing these facts won't leave anyone puzzled regarding the creation and funding of far right (if not neo-Nazi³⁴ or terrorist³⁵) brigades in Eastern Ukraine to fight separatist forces (e.g. the Azov Battalion).



Azov battalion members, NATO flag, Swastika, and Nazi salute.

1.4 It is the Last Straw that Breaks the Camel's Back

The Ukrainian crisis began after Viktor Yanukovich's government announced³⁶ the ending of preparations for the signing of an Association Agreement (AA) and Deep and Comprehensive Free Trade Agreement (DCFTA) with the European

³⁴ <https://www.telegraph.co.uk/news/worldnews/europe/ukraine/11025137/Ukraine-crisis-the-neo-Nazi-brigade-fighting-pro-Russian-separatists.html>

³⁵ <https://www.atlanticcouncil.org/blogs/ukrainealert/why-azov-should-not-be-designated-a-foreign-terrorist-organization/>

³⁶ <https://www.bbc.com/news/world-europe-25032275>

Union. This initiating event led to a massive protest³⁷ in the Ukrainian capital of Kiev. Besides, there were also other protests in many Ukrainian cities, even if those benefited of a lower media exposure. [Zelinska \(2015\)](#) demonstrates that President Viktor Yanukovich's pull out was not the only motive of protesters; human rights violations, total corruption and past political and institutional failures can be held responsible. Two weeks after the first protests in Kiev, Vladimir Putin –president of the Russian Federation– offered a financial lifeline to Ukraine. It was composed of a discount on natural gas prices and of a \$15,000,000,000 cash prize in loans. This move was certainly a try to counterbalance the aftermath of the refusal of Ukraine's agreement with the EU.

One month later –the 16th of January, the Rada passed a series of anti-protest³⁸ laws. The Ukrainian Parliament adopted measures to try to soothe protests in Maidan Nezalezhnosti (Independence Square). Reversely, tensions kept increasing and led one month later to a dramatic peak of violence and to the exile of Viktor Yanukovich –president of Ukraine. The total number of people killed during Euromaidan protests being 130, including 18 police officers. Snipers opened fire on both protestors and police³⁹. Even if the official investigation is over, there is still an ongoing debate⁴⁰ concerning the precise identity of snipers. However, the former president of Ukraine, Petro Poroshenko stated that these snipers –dressed as if they were members of the Security Service of Ukraine– were a part of a U.S. controlled false-flag operation. According to him, this operation happened in order to overthrow his predecessor. Moreover, he appealed⁴¹ to the country's constitutional court in order to make President Viktor Yanukovich ousting illegitimate. It might seem bold at first glance as doing so called into question his own presidential term. Alternatively, it might also be a strong indication of his theory's relevance.

³⁷ <https://www.nbcnews.com/news/world/massive-anti-government-rally-ukraine-turns-violent-flna2D11680261>

³⁸ <https://www.reuters.com/article/us-ukraine-law/ukraine-parliament-pushes-through-sweeping-anti-protest-law-idUSBREA0F12M20140116>

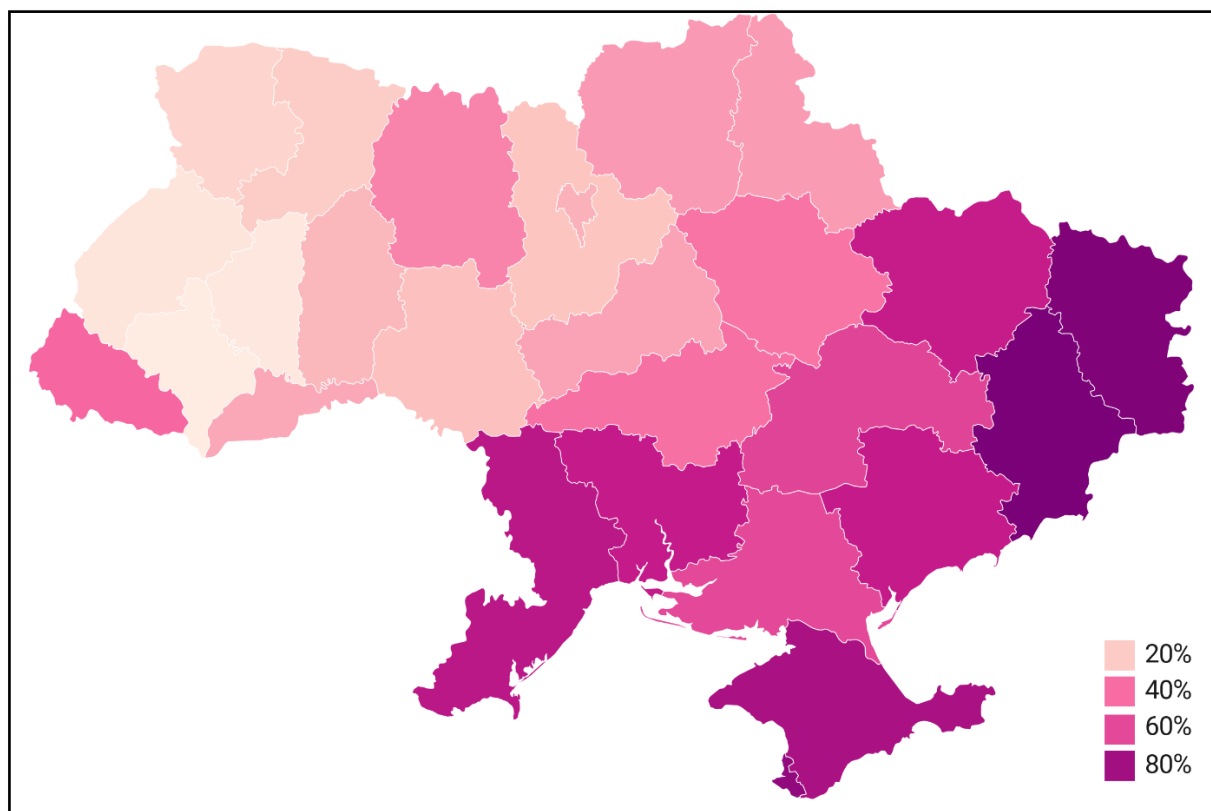
³⁹ <https://www.euronews.com/2014/02/20/sniper-fire-brings-disturbing-new-dimension-to-ukraine-violence>

⁴⁰ <https://consortiumnews.com/2019/04/22/the-buried-maidan-massacre-and-its-misrepresentation-by-the-west/>

⁴¹ <https://sputniknews.com/politics/201506201023639521/>

In any event, it shall not be forgotten that Viktor Yanukovich's stronghold is Eastern Ukraine. He served as governor of Donetsk Oblast from 1997 to 2002. Hence, he has demonstrated his pro-Russian stance several times. For example, one of his campaign promises⁴² was to adopt Russian as second state language in Ukraine. He also extended⁴³ the lease on Russia's naval base in Crimea until 2042, in exchange of a reduction in the price of Russia's natural gas. Finally, and regarding an even more sensitive topic, he stated⁴⁴ that the Holodomor was not a genocide against Ukrainians. After all, it was not such a surprise that he decided to suspend preparations for the signing of agreements with the EU (AA and DCFTA). Unsurprisingly, the majority of people of Eastern Ukraine as much as those of Crimea and Sevastopol voted for V. Yanukovich.

MAP I04
PERCENTAGE OF VOTES FOR YANUKOVICH (2010), SECOND ROUND



This fact and all elements previously mentioned (linguistic, ethnic, historic, economic and territorial) were an excellent breeding ground for what was coming next. Thus, right after Euromaidan, many pro-Russian demonstrations have been

⁴² <https://www.unian.info/politics/261325-extraordinary-session-of-vr-to-take-place-on-september-4.html>

⁴³ <https://www.theguardian.com/world/2010/apr/21/ukraine-black-sea-fleet-russia>

⁴⁴ <https://www.kyivpost.com/article/content/ukraine-politics/yanukovych-famine-of-1930s-was-not-genocide-against-65137.html?cn-reloaded=1>

observed in several cities of Eastern Ukraine (from the end of February 2014). These seemed to represent the backlash of Maidan protests and of Yanukovich's exile. Yet, the event that might have escalated these demonstrations into an armed pro-Russian insurgency might be the annexation of Crimea. Indeed, it is possible that separatist groups were inspired by Crimea's fate, hoping that a similar outcome would be possible for Eastern Ukraine. Remember that a referendum was held in Crimea on the 16th of March. Its official result was a 97% for the integration of the region to the Russian Federation. It is important to know that the vote was largely boycotted by Crimean Tatars⁴⁵. However, as they are a minority in Crimea, it is highly unlikely that their vote would have much changed the results.

Right after the referendum, the Supreme Council of Crimea and Sevastopol City Council declared the independence of the Republic of Crimea from Ukraine⁴⁶. Moreover, they also applied to join the Russian Federation. On March 17, President Vladimir V. Putin signed a decree formally recognising Crimea as a sovereign and independent state. From the 18th of March, Russia then officially incorporated Crimea and Sevastopol as two federal subjects of the Russian Federation. Donetsk and Luhansk regions became the theatre of an internecine war between pro-Russian separatists (whose ranks were joined by Russian and Don Cossacks⁴⁷) and the Ukrainian army (largely backed by far-right Ukrainian volunteer battalions, which even attracted⁴⁸ many foreign neo-Nazi extremists from Western countries). The Donbas became a proxy war as separatists obtained equipment as much as light & heavy weapons from Russia, while Ukrainian far-right units were trained, equipped, and funded by many Western countries (directly or indirectly). Thus, if Russian volunteers in Eastern Ukraine have been called "little green men" (*зелёные человечки*) as they were wearing Russian military clothes and equipment without insignia & patches, it is possible to call

⁴⁵

https://web.archive.org/web/20140317215837/http://www.ukrinform.ua/eng/news/mejlis_to_boycott_crimean_referendum_318219

⁴⁶ <https://www.rt.com/news/crimea-parliament-independence-ukraine-086/>

⁴⁷ <https://www.youtube.com/watch?v=2cR29jDM4KA&t=0s>

⁴⁸ https://www.vice.com/en_us/article/vb95ma/far-right-extremists-have-been-using-ukraines-civil-war-as-a-training-ground-theyre-returning-home

members of Azov battalion “little atlantist men” as they were wearing Western MultiCam and equipment.



Members of Azov Batallion wearing U.S. MultiCam and OPS-CORE helmets.



“little green men” wearing Russian EMR⁴⁹ camo and Russian 6b27 helmets.

⁴⁹Edinaya maskirovochnaya rascvetka (единая маскировочная расцветка).

To conclude, the Ukrainian crisis is far from being a simple political crisis. Things are more complex than the Western storytelling in which Russia suddenly decided to invade Ukraine –out of nowhere– in order to extend its territory. The reality is that Donbas war and Crimea’s annexation are firmly deep-rooted in a soil mixing a historical resentment, a feeling of ethnolinguistic exclusion, and a sentiment of economic and territorial unfairness.

2. European Sanctions and Russian Countermeasures

The Ukrainian crisis of November 2013 led to the proclamation of independence of the Republic of Crimea in March 2014, and its attachment to Russia. This attachment, recognised by Russia and contested by a large number of Western countries, triggered an international crisis between the Russian Federation and the West (the European Union, the United States of America, *et cetera.*) Additionally, the Russian Federation has been accused of providing light equipment and heavy weapons to Ukrainian separatist forces and even to allegedly invade Eastern Ukraine. As a means of applying pressure on Russia, Western countries decided to launch a set of international sanctions. These sanctions concern mainly technologies related to military use, to the petroleum industry, transferable securities, and more largely to financial activities with Russian financial institutions. In response, Russia announced counter-sanctions and implemented a large food embargo on European products.

2.1 European Sanctions

On the basis of [Consolidated version of Council regulation \(EU\) No. 692/2014](#), on [Regulation \(EU\) No. 833/2014](#), and on [Council Decision 2014/145/CFSP of 17 March 2014](#), European restrictive measures can be summed up into four main categories:

- ❖ **Economic:** They can have either an individual nature (i.e. they precisely target individuals, companies, or other legal entities) or, reversely, a general nature.
 - *Of a general nature:* a ban on providing goods to Crimea related to transport, telecommunications and energy sectors such as the exploration of oil, gas,

and mineral resources. A prohibition to export arms, dual-use goods, and materials for military use in Russia. Finally, exports of energy-related (mostly deep-water oil exploration) equipment to Russia are either banned or submitted to authorisation.

- *Of an individual nature*: investments in Crimea (for European companies) are prohibited as much as providing tourism services in Crimea or Sevastopol (ships may not call at ports in the Crimean peninsula).

❖ Financial: financial instruments exceeding a 30-day maturity cannot be bought or sold to some Russian entities, as much as financial assistance related to these.

❖ Technological:

- Technologies related to transport, telecommunications and energy sectors such as the exploration of oil, gas, and mineral resources (to Crimea).
- Technical assistance related to infrastructure construction (to Crimea).
- Technology for military use (to Russia).
- Technology⁵⁰ and services related to deep-water oil exploration are prohibited (to Russia).

❖ Individual: Asset freeze and visa bans, targeting either individuals or companies.

The complete list of persons, entities, and bodies targeted by European (individual) sanctions is available online on EUR-Lex portal at this [address](#)⁵¹.

The main roots of these sanctions were set up during spring 2014, and have been extended since. At the time of writing, European sanctions are still effective, and Russia has not changed its position regarding the annexation of Crimea. However, as described, European measures are many, and their ability to inflict economic pressure varies. In this thesis, each of these sanctions is taken into account in the sanction index construction (see Chapter II). In addition, it must be admitted that “European sanctions”, “European measures”, *et cetera*, all refer to sanctions mentioned above.

⁵⁰ An important fact here is that technologies related to the gas are not under sanctions.

⁵¹ <https://eur-lex.europa.eu/legal-content/en/TXT/?qid=1521625455688&uri=CELEX:02014D0145-20171121>

2.2 Russian Countermeasures

Almost immediately after the first set of European (and international) coercive measures, the Russian Federation implemented its own reciprocal measures. These individual sanctions were mostly targeting American officials and will not be studied in this work. However, a more effective answer to international sanctions didn't take long to come since Vladimir V. Putin, president of the Russian Federation, signed the Executive Order on special economic measures on 6 August 2014 ([Decree of the President of the Russian Federation of August 6, 2014 N 560](#)). This decree was the beginning of a large embargo (of certain agricultural products, raw materials and foodstuffs) against countries that had sanctioned Russia. This embargo is based on four government resolutions: (i) No. 778 (06/08/2014); (ii) No. 830 (20/08/2014); (iii) No. 472 (27/05/2016); (iv) No. 1292 (25/10/2017).

TABLE I-1
UNDER-EMBARGO PRODUCTS

<i>SITC</i>	<i>Details</i>
1	Living animals (added in 2017, Resolution No. 1292)
2	Meat and food meat sub-products
3	Fish and crustaceans, molluscs and other aquatic invertebrates
4	Milk products; birds eggs; natural honey; foods of animal origin, not elsewhere specified or included
7	Edible vegetables and certain roots and tubers
8	Edible fruit and nuts; citrus peel or crusts melons
15	Animal fats and oils or vegetable origin and their cleavage products; prepared edible fats; waxes of animal or vegetable origin (added in 2017, Resolution No. 1292)
16	Preparations of meat, fish or crustaceans, molluscs or other aquatic invertebrates
19	Prepared of cereals, flour, starch or milk; floury confectionery products
21	Other juice mixture without additives sugar value not exceeding 30 per 100 kg net weight, c brix not more than 67

Source: Presidential decrees No. 778, 830, 472, 1292, Russian Federation.

The pillar of the embargo is the resolution No. 778 (most goods targeted by the embargo are listed in this resolution), even if resolution No. 560 was published one day before (it doesn't specify any products list). Other resolutions are add-ons that either integrate new products in the embargo, or provide details regarding exceptions and control measures. It is important to note that while resolution No. 830 adds exceptions for goods intended for manufacturing baby food, resolution

No. 472 is setting-up new methods of control. A monitoring procedure had to be enacted since many companies were cheating. They were declaring that some goods were imported in order to be used for baby food, while in the end, they were not. Finally, resolution No. 1292 was established almost three years after the beginning of the embargo, and adds living animals and edible fats to the embargo. In order to ease the reading of these resolutions, Table I-1 is making a simplified list. It has been decided to rank products depending on their category (chapter from the Russian customs tariff codes). Naturally, it does not mean that the entire category of products is targeted by the embargo. Details regarding each product targeted by this or that government resolutions can be found in Appendix I-1.

3. Initial Assessment of Sanctions' Effects

Papers focusing on the economic conflict between the European Union and Russia are many, but quality is not taken for granted. In order to have a first assessment of sanctions effects, the most relevant writings have been examined. This section regroups their findings and highlights general trends in their analysis. Results are gathered in three subsections:

1. Economic Effects: regroups effects on GDP and on trade.
2. Financial and Monetary Implications: treats of changes related to the financial and monetary sphere.
3. Oil Sector: focuses on eventual effects on the oil industry.

3.1 Economic Effects

Do sanctions have an effect on economies targeted? A simple way to answer this question is to check how GDP of involved economies react to sanctions. Several sources tried to measure it (see Table I-2). Thus, depending on sources, it seems that coercive measures would have cost to the Russian economy from 0.2% to 9% of its GDP per year, with an average of 2.3% among studied papers. For the European Union, it seems that sanctions' impact is much lower. That being said, there aren't many contributions studying the precise question of sanctions effects on European economies. Some have been studying the exposure of small European

economies to this economic conflict. [Oja \(2015\)](#) states that small economies are more exposed, because of their higher dependency to trade with Russia. Indeed, it seems that Baltic sea countries suffered more than others. The author reveals that intra-EU and intra-Baltic trade in goods affected by sanctions is considerable (from 0.2 to 0.5% of their GDP). Even if this finding is then minimised by the deduction of re-exported goods from calculations, similarities in trends exist in [Havlik \(2014\)](#) and [Haraldsson and Skúlason \(2016\)](#).

TABLE I-2
SANCTIONS' EFFECTS ON GDP

<i>Authors</i>	<i>Sanctions from</i>	<i>GDP of</i>	<i>Effect on the GDP</i>
Finance Minister Anton Siluanov (RU) ⁵²	All	RU	2%
Deputy Minister Economic Development Alexei Likhachev (RU) ⁵³	EU & RU	RU	2%
IMF ⁵⁴	All	RU	1-1.5% in medium term & 9% cumulative impact
Unpublished European Commission Study ⁵⁵	EU	RU	0.6% in 2014 & 1.1% in 2015
	EU	EU	0.2% in 2014 & 0.3% in 2015
Davis (2016)	All	RU	3.8% (growth deceleration)
Aalto and Forsberg (2016)	All	RU	1-1.5% per year
Ashford (2016)	All	RU	3%
Kholodilin and Netsunajev (2016)	All	RU	2% points GDP quarter-on-quarter growth
Kholodilin and Netsunajev (2019)	All	RU & EU	Small effects on GDP
Oja (2015)	RU	Baltic countries	0.2% - 0.5%
Havlik (2014)	All	RU	1% in 2014-2016 ; 20 b€ in 2014, 30 b€ in 2015, 50 b€ in 2016
Harrell and Rosenberg (2016)	All	RU	1% to 2%

Trade is another important indicator of sanctions' effects, but the literature focuses more on trade changes. [Christen et al. \(2015\)](#) provided simulations⁵⁶ where it is stated that European sanctions and Russian countermeasures are likely to cause

⁵² [Russell \(2016\)](#)

⁵³ Ibid., 1.

⁵⁴ <https://www.imf.org/en/News/Articles/2015/09/28/04/53/socar080315b>

⁵⁵ <https://www.wsj.com/articles/eu-projects-impact-of-sanctions-on-russian-economy-1414583901>

⁵⁶

https://www.wifo.ac.at/jart/prj3/wifo/resources/person_dokument/person_dokument.iart?publikationsid=58220&mime_type=application/pdf

a limited impact on economies within the EU. To them, this is because the share of products targeted by coercive measure is rather low. This assumption is also used in [Davis \(2016\)](#). They put macroeconomic effects of trade loss on a “general worsening of trade relations between the EU plus Switzerland and Russia” ([Christen et al. \(2015\)](#), p. 1). In [Havlik \(2014\)](#) trade losses are not measured (since the study has been done at an early date), however, they state that the overall exposure of the EU to the economic conflict is low. Baltic states seem to be the only exception.

TABLE I-3
SANCTIONS' EFFECTS ON TRADE

<i>Authors</i>	<i>Effects</i>
Christen et al. (2015)	From 34 to 92b€ of trade loss ; 30b€ exports decline over the last quarter of 2014; Decline in exports and tourism expenditure from 44 to 92b€, jobs lost from 0.9 to 2.2 million
Dragoi and Balgar (2016)	75b€ of EU-Russia trade decline ; 30b€ trade loss for the EU
Nureev and Petrakov (2016)	Imports decline: meat and poultry (-30% 2014), pork (twice less), cheese (-20%), flour grains and leguminous crops (-40%) Russia's import share from EU -48.8% (Jan-Oct 2014) and -45.3% (Jan-Oct 2015) ; share from APEC +26.6% and 27.9% respectively ; share from CIS unchanged (0.9%points decrease for Ukraine while others increased (particularly Belarus)
Szczepański (2015)	In 2014, -12.1% EU exports to Russia ; -13.5% imports from Russia ; 41b€ of total trade value decline EU agri-food exports to Russia fell by 43% (no only goods concerned by the embargo)
Leering and Nassiri (2014)	130 000 jobs potentially lost in the EU
Gros and Mustilli (2016)	Sanctions impact on trade flow is minimal
Haraldsson and Skúlason (2016)	Small economies are more exposed to trade loss
Davis (2016)	Russian counter-sanctions have negligible effects and
Ashford (2016)	Russian embargo created shortages and increased food prices in Russia; Germany has 400 000 jobs at stake.

As described in Table I-3, effects of both Western and Eastern coercive measures on trade are not clearly defined in the literature. The main issue is that authors failed in studying an overall impact of sanctions. In other words, they are not observing sanctions effects on each country, one by one, sector by sector, product

by product. For this reason, it is hard to compare the results of one paper to those of others as methodology differs. Some decided to focus on a descriptive statistics approach as in [Nureev and Petrakov \(2016\)](#), others used short-term vs long-term forecasting –as [Christen *et al.* \(2015\)](#), while a few provided econometric studies. Nevertheless, trends seem quite clear: (i) there are billions of euros' worth trade losses for both sides; (ii) it seems that hundreds of thousands of jobs have been lost, at the very least; (iii) sanctions deteriorate trade in general and not only goods targeted by coercive measures, see [Szczepański \(2015\)](#) ; (iv) small economies suffer more than others. Another aspect is the fact that some trade ties are definitely broken. It doesn't really matter now whether the EU decides to lift sanctions or not, since goods under the Russian embargo were either imported from third parties or directly produced in Russia, see [Davis \(2016\)](#) and [Romanova \(2016\)](#). This fact was predicted quite early in the literature. [Jones and Whitworth \(2014\)](#) were already supporting that Russia will certainly exploit new economic relationship, in order to find permanent alternatives to European goods. It does make sense, since it decreases Russian exposure (both economic and diplomatic) to future coercive measures from the West, without falling into the trap of autarchy. Moreover, [Davis \(2016\)](#) states that positive effects of these measures are a substantial surplus in the current account (7% of GDP) and a sharp reduction in external debt (to 29% of GDP).

[Gros and Mustilli \(2016\)](#) follow an interesting logic, which is that in order to study changes in trade due to sanctions, one shall look at the share of the sanction sender in the target's imports. For example, if the share of the EU in Russian imports didn't change, sanctions cannot be held responsible for undermining trade between the EU and Russia. Following this logic, they conclude that the impact of sanctions on trade is minimal, and that observed fall in the EU exports to Russia is due to the recession in Russia. Moreover, they find that the share of CIS countries in Russian imports has not increased after the establishment of coercive diplomatic measures. The same finding also appears in [Nureev and Petrakov \(2016\)](#), see *p.* 170. Yet, if it is true that this way of proceeding is interesting, it also has a major bias. Indeed, studying the overall share of European goods in Russian imports implies that goods which aren't under-sanctions could perfectly counterbalance

trade changes of goods targeted by sanctions. As a matter of fact, it is entirely possible that the decrease of one good is –simultaneously– compensated by the increase of another product. Thus, in order to be rigorous, one shall (instead of studying the overall share of EU countries in Russian imports) observe the share of goods targeted by sanctions, one by one. In other words, it means comparing differences in shares of EU under-sanction goods in Russian imports, next to “sanction-free” European goods. This is achieved in section “c. Changes in EU-Russia Trade”. Within the same framework, [Gros and Mustilli \(2016\)](#) state that the share of non-CIS countries in Russian imports does not seem to have been affected by sanctions, and that the share of CIS countries has not increased either. This finding seems to go against the third-party theory, since it means that Russia didn't use countries uninvolved in the economic war to circumvent international measures. Nureev and Petrakov (2016) obtain similar results with the major exception that they observe a decline in Ukraine's share, and an increase in Belarus' one.

Nevertheless, these findings cannot single-handedly demonstrate that the third-party strategy was not performed. Mostly since a country-by-country analysis was not achieved. It is highly likely that some CIS countries didn't increase their trade with Russia because of sanctions, and those candidates could create mathematical disruptions in calculation modalities –changes in one variable may come in conflict with others. In the same vein, a similar bias exists in [Kholodilin and Netsunajev \(2016 ; 2019\)](#); one must remember that we cannot compare apples and pears. As a matter of fact, authors compare sanctions' effects on the sum of all Euro Area GDP to the lone Russian GDP. The problem of doing so is that if it is true that some European economies suffered from the Russian embargo –particularly countries of the Baltic Sea and other small economies, see [Havlik \(2014\)](#), [Oja \(2015\)](#), [Haraldsson and Skúlason \(2016\)](#), others didn't. Some countries are less sensitive to Russian countermeasures since Russia represents a small share of their trade (export to Russia), and because this small share itself is a small share of their GDP (Malta, Spain, Croatia, Portugal, the United Kingdom, and so on). Ineluctably, it means that some economies might counterbalance others, and thus have the ability to create statistical and econometric limitations.

3.2 Financial and Monetary Implications

Financial sanctions led to major state interventionism. Several authors highlight the fact that the Russian Central Bank had to use the National Welfare Fund to support the rouble and set up a recapitalisation program –bail out program, see [Davis \(2016\)](#), [Jones and Whitworth \(2014\)](#), [Aalto and Forsberg \(2016\)](#), [Ashford \(2016\)](#), [Harrell and Rosenberg \(2016\)](#), [Nikulina and Kruk \(2016\)](#). In addition, it seems that Russia had to spend less on health care infrastructure, government salaries, and other targeted cuts to the state budget. The use of the Welfare Fund wasn't done without consideration. Indeed, according to the literature, the Russian government pressured banks to convert their debt in rouble, even offering to compensate losses. As a result, a drop in foreign reserves has been observed. [Aalto and Forsberg \(2016\)](#) claim that Russian Central Bank spent \$76,000,000,000 and €5,400,000,000 on buying roubles, while [Harrell and Rosenberg \(2016\)](#) put the figure at \$150,000,000,000.

Another important fact is that the Russian currency was allowed to float freely in November 2014, letting the market set the exchange rate. This measure allowed the Russian economy to adapt faster to changes, and increased the credibility of the Russian Central Bank –certainly with the hope to attract foreign investments. That being said, one must be careful and avoid assuming that all of the above is due to international punishment against Russia. [Dreger et al. \(2016\)](#)⁵⁷ studied the 2014 Russian rouble's depreciation. They tried to isolate effects of sanctions from the collapse of oil prices, and their conclusion is that most of the rouble depreciation is due to oil prices. Consequently, and knowing that currency depreciation can affect the economy through several canals (domestic investment, stock market performance, export promotion, and so on), most changes that are directly accountable to the Russian rouble depreciation are indirectly due to oil prices (and certainly not to economic sanctions). Banks, companies and private individuals would have faced significantly fewer difficulties if sanctions would have been established in a situation with stable oil prices. This is why it seems

⁵⁷ The sanction index that they are using is far from being perfect. See Chapter II for further details.

quite reasonable to admit that sanctions mostly acted as a catalyst and not as a triggering event of state interventionism.

“Western policymakers got lucky” [Ashford \(2016\)](#), p. 114.

Financial sanctions also have an incidence on funding modalities because of the limited access to European capital markets, see [Pak and Kretzschmar \(2016\)](#). Very concretely, it seems that banks and firms had to obtain capital from other markets. For example, [Nikulina and Kruk \(2016\)](#) state that the Russian government was forced to deal with Chinese banks, where interest rates are higher (up to 15 times more) and where there are conditions to loans (as the integration of a % of goods and services from Chinese companies). [Davis \(2016\)](#) goes further and mentions informal funding channels. Some⁵⁸ even mention the fact that Russia is studying the feasibility of investing in cryptocurrencies in order to circumvent sanctions. If the use of cryptocurrencies remains eventual, several coping mechanisms have been observed.

[Jones and Whitworth \(2014\)](#) remind that the exclusion of Iran in March 2012 from the Society for Worldwide Interbank Financial Telecommunication (SWIFT) network has not been forgotten. Moreover, [Ashford \(2016\)](#) underlines that U.S. senators and some European government suggested to cut off Russia's access to the SWIFT payment system. He also highlights that in March 2014, Visa and Mastercard suspended all transactions from four Russian banks, forcing the U.S. government to intervene for payment to start being processed again. From that point onwards and in reaction to these negative signals from the West, what had to happen very naturally happened. As [Drezner \(2015\)](#) explained it, the President of the Russian Federation, Vladimir V. Putin, called for the development of measures to prevent future harassment from countries that disagree with foreign policy decisions. It includes negotiations with other BRICS states in order to create: (i) an alternative to the SWIFT network; (ii) the New Development Bank (NDB) to assume functions of the IMF and the World Bank. The first has been

⁵⁸ <https://www.telegraph.co.uk/technology/2019/01/14/russia-plans-tackle-us-sanctions-bitcoin-investment-says-kremlin/>

created and is effective within Russia, under the name “SPFS⁵⁹ (System for Transfer of Financial Messages)”. If it is still impossible to say that it is replacing the SWIFT network –since it was covering 15%⁶⁰ of Russia’s internal traffic in 2019, its share of internal traffic keeps increasing year after year. The second was achieved in July 2014. Moreover, the Central Bank of Russia also adopted its own payment system (MIR, Мир) in May 2017. If this system is not commonly adopted yet, it remains mandatory for state employees⁶¹. In November 2019, Russian banks had already been issuing more than 69.7 million MIR cards. From a different perspective, Russia also increased IT security among state and municipal employees. For example, the Government of the Russian Federation decided⁶² to supply state and municipal agencies with Russian-made telecom and software. Foreign software is forbidden if a Russian version is available. Finally, more recently, the State Duma adopted a bill⁶³ which is forcing producers of “technically complex goods” (smartphones and so on) to provide goods where the consumer must have the opportunity to use preinstalled Russian programs for electronic computers. The goal of these IT-related measures (as much as MIR payment system) might be to protect the State apparatus from both external interference (safety is far from being optimal when government services use foreign-made software) and future international coercive measures. They can be seen as state provisions in order to ensure future Russian sovereignty in IT. One must admit that sanctions led to strategically pragmatic measures.

3.3 Oil Sector

An entire ridge of sanctions against Russia is targeting the oil sector. [Aalto and Forsberg \(2016\)](#) explained that the 70% state-owned Rosneft (largest oil production company of Russia in 2016) needed new technologies (and foreign partners) in order to meet its production targets. They mention brownfields in western Siberia,

⁵⁹ Система передачи финансовых сообщений.

⁶⁰ According to Alla Bakina, director of the Bank of Russia’s national payment system.

⁶¹ Federal Law on the National Payment System No. 88-FZ, 01.05.17 (Закон о национальной платёжной системе НОМЕР 88 –ФЗ, 01.05.17)

⁶² Resolution of the Government of the Russian Federation of November 16, 2015 No. 1236 (постановление правительства рф от 16 ноября 2015 Г. N 1236)

⁶³ Bill of the State Duma No. 757423-7;1.1, 18.07.19 (Государственная Дума ФС РФ Дата 18.07.2019 №757423-7; 1.1)

Arctic offshore in the Barents and Kara Seas, in sub-Arctic conditions in Timan-Pechora, eastern Siberia and Sakhalin. Yet, sanctions led to the withdraw of some partners (such as the American Exxon) and delayed Rosneft's projects. In another example, they mention the fact that the 50% state-owned Gazprom, is operating the world's only Arctic offshore oil drilling platform in the Pechora Sea, and that half of the platform's technology was coming from countries committed to sanctions. [Nikulina and Kruk \(2016\)](#) also insist on the fact that foreign technologies are essential since Russian Arctic shelf projects are unique in natural, climatic, and technical conditions. However, it seems that Russia once again established coping mechanisms. In an interesting but quite subjective brief, [Shagina \(2018\)](#) states that Russia had to turn to Asian partners such as China, Japan, and South Korea. Moreover, Russia also decided to promote import-substitution strategy in oil-related technologies (see *pp. 9-10*). This information also appears in [Kravets \(2015\)](#), where it is added that Russian companies Izhneftemash, PromTechInvest, Uralmash and Wormholes Vnedrie were testing technologies in China and Vietnam. However, [Shagina \(2018\)](#) claims that these Russian-made technologies are expensive and have a low quality (this statement is not demonstrated). Nevertheless, if it is hard to measure technology losses and additional costs in such situation (because of the technological complexity), it is easy to understand that the oil sector has been delayed because of sanctions, while some projects were even stopped (such as the cooperation⁶⁴ between Oracle and Gazprom, Rosneft, Surgutneftegaz and LUKOIL).

Let us resume for an instant. Russia, because of sanctions, had either to give up on some projects in the Arctic or to find new partners to obtain technologies (costing more and with a lower efficiency). Yet, is it really a bad thing? One needs to remember that, simultaneously to sanctions, oil prices collapsed. This is very interesting. Indeed, the fact is that Arctic drilling is quite expensive. Oil drilling in these extreme conditions induces quite high prime costs. The number that is brought up is around⁶⁵ 100 USD per barrel. Yet, knowing that oil price collapsed

⁶⁴ <https://news.rin.ru/eng/news///145775/>

⁶⁵ <https://www.spiegel.de/international/business/new-estimates-for-drilling-costs-the-exorbitant-dream-of-arctic-oil-a-741820.html>

from 108.12\$ in April 2014 to 36.48\$ in January 2016, sanctions appear to be rather a blessing than a curse. It seems that Russia's oil industry –which was forced to delay its projects in the Arctic– has been protected from huge loss of profits, thanks to international sanctions.

4. Changes in EU-Russia Trade

This section begins with a short description of data, which mostly describes databases that have been used. Then comes a general overview focusing on trade between the European Union and Russia. Data from a witness year (2012) are compared to a test year (2018). The goal is to obtain pictures of trade, depending on whether the embargo was established or not. Trends are also described on the basis of historical values starting in 2000. Afterwards, trade decomposition of the EU exports to Russia and the other way around are examined through the main SITC sections. This general overview is followed by a subsection studying the partial implementation (or respect) of the Russian embargo. The analysis focuses first on the European Union as a lone entity, and then goes further by treating each country independently. Nevertheless, the real country analysis starts in the next subsection; the ten greatest European exporters to Russia are examined independently. It will study the value of their total exports to Russia, the value of under-embargo products exported before and during the embargo, their place in the embargo violator ranking, the structure of their trade with Russia, *et cetera*.

4.1 Databases

Several databases have been used in this section. The main data source is Eurostat, and it has been decided to use the Standard International Trade Classification (SITC) because databases following this classification were often the most complete available –they minimise the number of missing values. Thence, many adjustments have been made to raw data in order to obtain databases adapted to this work. Therefore, for scientific transparency, it is important to provide details regarding these adjustments. Key information about all databases can be found in Annexes, [Table I-5](#). In parallel, it is important to remember that the witness period (W) starts in 2009m5 and ends in 2014m8, while the test period

(T) starts in 2014m9 and ends in 2019m12. For this reason, yearly databases using these periods have data calculated in the following way:

- **Witness Period** - It is the sum of 2010, 2011, 2012 and 2013 yearly values, to which is added: (i) 2009's yearly value multiplied by $\frac{8}{12}$ (to have an equivalent of monthly values from 2009m5 to 2009m12) and (ii) 2014's yearly value multiplied by $\frac{8}{12}$ (to have an equivalent of values from 2014m1 to 2014m8).
- **Test Period:** It is the sum of yearly values of 2015, 2016, 2017, 2018 and 2019, to which we add 2014's yearly value multiplied by $\frac{4}{12}$ (to have an equivalent of monthly values from 2014m9 to 2014m12).

Additionally, the following list will provide further elements regarding databases that received the biggest adjustments.

- **“T10_RU_XV0-9_y”**: exports of T10 to Russia, depending both on SITC sections (from 0 to 9) and on periods (W & T).
- **“T10_RU_MV0-9_y”**: imports of T10 to Russia, depending both on SITC sections (from 0 to 9) and on periods (W & T).
- **“EU_RU_XVTss_m”**: since Russian official documents listing under-embargo products follow the Harmonized System (HS) international nomenclature, it was necessary to use a correlation and conversion table from HS to SITC (Appendix I-2) in order to obtain the SITC list of under-embargo products (Appendix I-3). Then, products from this very precise list were extracted from Eurostat database, in order to have the lone EU28 to RU total exports of under-embargo products.
- **“EU_RU_MVTss_m”**: *ibid.*, with total imports of under-embargo products from RU.
- **“EU_RU_XVToe_y”**: this database regroups EU28 total exports to RU reduced by under-embargo products from “EU_RU_XVTss_m” (to that end, monthly data were converted in yearly data).
- **“EU_RU_MVToe_y”**: *ibid.*, with total imports from RU reduced by “EU_RU_MVTss_m”.

Finally, it is possible that in Subsection iii, “A Partially Implemented Embargo”, witness period starts in 2010m9 and ends in 2014m8 while the test period is shorter and ends in 2018m8 instead of 2019m12. Indeed, as values from 2014m8 to 2019m12 weren’t available, it has been decided to adjust periods in order to keep comparing apples to apples. In addition, as growth rate averages are calculated through periods, it is important to keep similar frequency, starting date, ending date, and thus observation number. However, when this adjustment occurs, it will be specified.

TABLE I-4
ABBREVIATIONS USED IN THIS SECTION

<i>Abbreviation</i>	<i>Meaning</i>
m€	Million euros
b€	Billion euros
pp	Percentage point
wp	Witness period (2009m5 – 2014m8)
tp	Test period (2014m9 – 2019m12)
RU	The Russian Federation
WO	Countries of the World (from Eurostat list)
EU28	The European Union, 28 members. *
T10	10 greatest EU28 exporters to Russia: Germany, Italy, France, the Netherlands, Poland, Finland, the United Kingdom, Belgium, the Czech Republic, Lithuania. **

**In data, each country of the EU28 is processed independently from others. It is not a sum of values of all EU28. Countries which weren't yet members of the EU at the data's time are still processed (their historical data are required for calculations).*

***Similarly, countries are processed independently.*

4.2 General Overview

Trade between the European Union and Russia can be described with several key data⁶⁶. Before sanctions, the European Union has exported goods to Russia for a total value of 454.73b€⁶⁷, while the European Union imports from Russia reached 809.20b€⁶⁸. Since the European Union imports from Russia are Russia’s exports to the European Union, Russia was exporting 354,47b€⁶⁹ more than the European Union before sanctions. Hence, it highlights a deficit in the European Union trade balance, and therefore a higher exposure to Russian economic coercive measures (giving a greater leverage of Russia over the EU). In 2012, the European Union

⁶⁶ Main data source of this section: Eurostat.

⁶⁷ From 2010m9 to 2014m8.

⁶⁸ Ibid.

⁶⁹ Ibid.

exported a total of 4523.77b€ to all countries of the world, while Russia was at 408.18m€⁷⁰. It means that the share of exports to Russia in European exports to the world in 2012 is 2.73%, while the share of exports to the European Union in Russia's exports to the world is 52.7%. Thus, the balance is once again unequal, even if from this perspective Russia seems to have a higher dependency –and thus exposure– to trade with the European Union. Thus, the EU-Russia trade reveals clear inequalities in trade dependencies. Nevertheless, a country-per-country analysis is necessary to know if some European countries have a greater dependency on Russia than others.

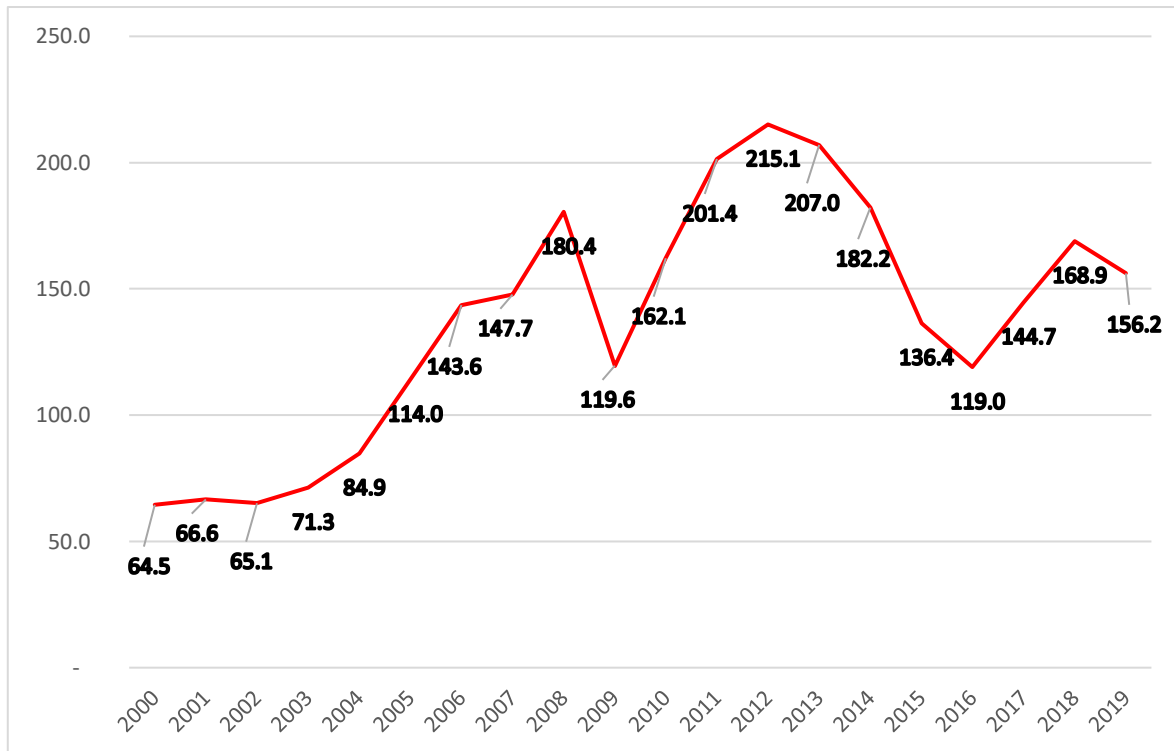
Trends are changing during sanctions⁷¹ since European exports to Russia are 31.11% lower –their value is 123.5b€, which means that they decrease by 38.42b€. Similarly, European Union imports from Russia reach 168.92b€ and are 21.47% lower –decreasing by 46.19 m€. The EU28-Russia trade balance is still in deficit, but with a lower value (-83.84b€ in 2018 / -91.61b€ in 2012). In 2018, the share of exports to Russia in European exports to the world was 1.55%, decreasing by 1.18 pp in comparison to 2012. The same year, Russia exported to the world goods for a total value of 382.13b€⁷², and exported goods to the European Union for a value of 168.92b€. The share of export to the European Union in Russia's exports to the world was 44.2% (decreasing by 8.5 pp in comparison to 2012), slightly reducing Russia's dependency on trade with Europe. It is clear that the total trade between the European Union and Russia decreased once sanctions were established. Surprisingly, Russian exports to the European Union also decreased, even if the EU was not targeting trade. Less surprisingly, European exports to Russia collapsed.

⁷⁰ Original data in USD = 524 766 420 610\$ (World Integrated Trade Solution), converted in €, average exchange rate (2018) of 1€ = 1.2856\$ (Data source: European Central Bank).

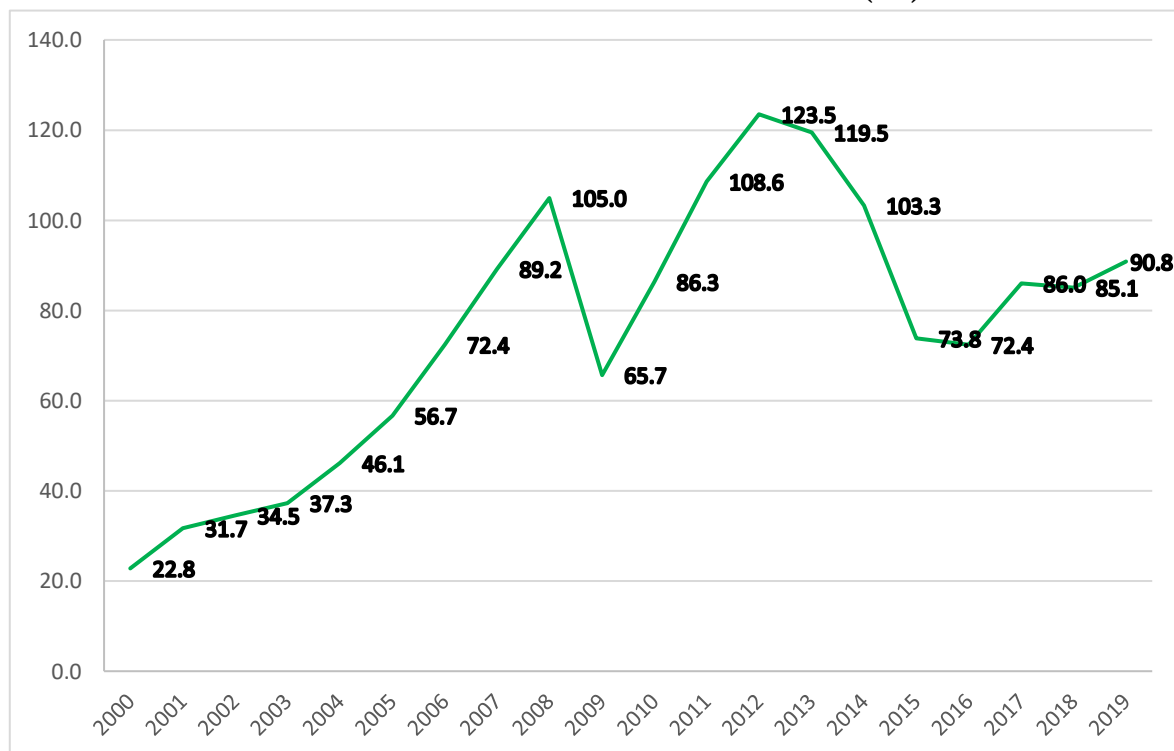
⁷¹ The reference year is 2018.

⁷² Ibid., Original data in USD = 451 494 828 170\$ (WITS), average exchange rate (2018) of 1€ = 1.1814\$ (ECB).

GRAPH I-1
RUSSIA'S TOTAL EXPORTS TO THE EU (B€)

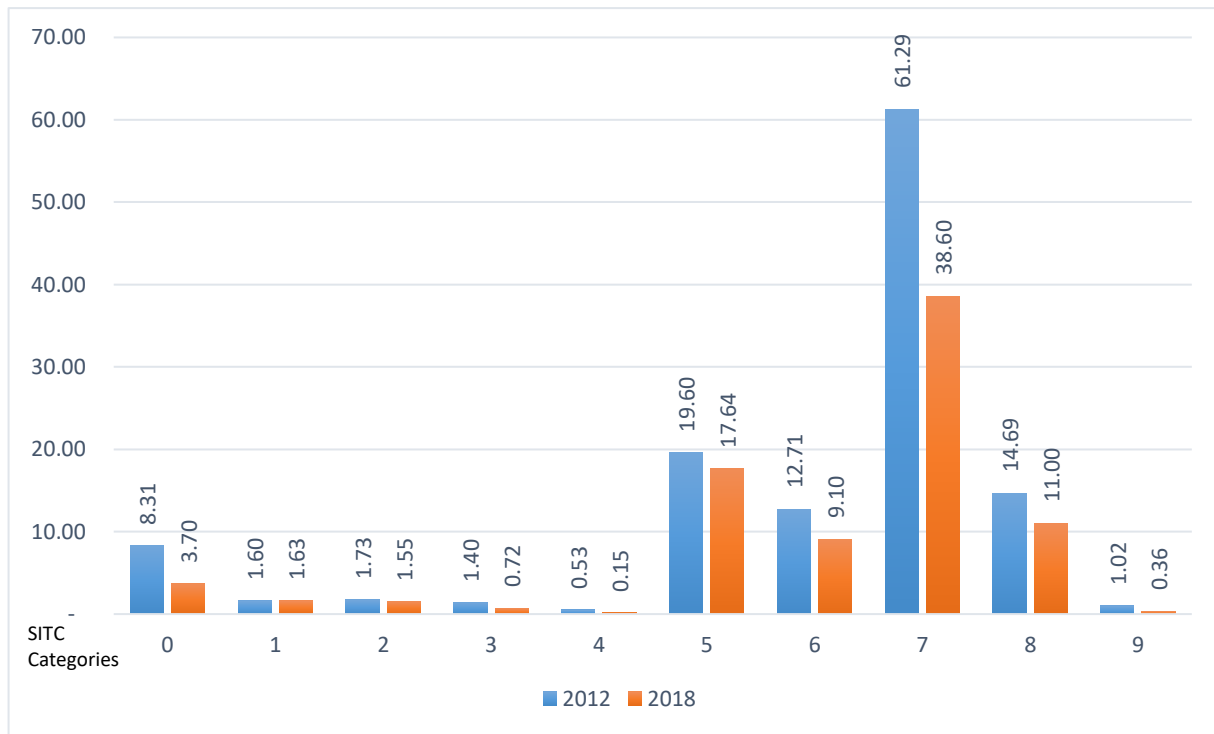


GRAPH I-2
EUROPEAN TOTAL EXPORTS TO RUSSIA (B€)



Trade decomposition is also an important matter. It reveals a new dichotomy between our actors. The European Union mostly exports products out of the following SITC sections (in order): 7 – *Machinery and transport equipment*; 5 – *Chemicals and related products*; 8 – *Miscellaneous manufactured articles*; 6 – *Manufactured goods classified chiefly by material*. For its part, Russia mostly exports products from SITC Section 3 – Mineral fuels, lubricants and related materials. Such decomposition also clearly shows that trade structure between the European Union and Russia didn't change much. Between 2012 and 2018, players were still exporting the same type of products, besides economic sanctions. To go further, variations between 2012 and 2018 among all SITC sections have been calculated. Table I-6 shows that most SITC sections of European exports decrease between 2012 and 2018. Conversely, Russian exports have several sections that increase, even if the most exported section decreases by almost 30% (see Table I-7). To go further, variations between 2012 and 2018 among all SITC sections have been calculated. Table I-6 shows that most SITC sections of European exports decrease between 2012 and 2018. Conversely, Russian exports have several sections that increase, even if the most exported section decrease by almost 30% (see Table I-7).

GRAPH I-3
TRADE DECOMPOSITION – EU28 EXPORTS TO RUSSIA (B€)



GRAPH I-4
TRADE DECOMPOSITION – RUSSIA'S EXPORTS TO EU28 (B€)

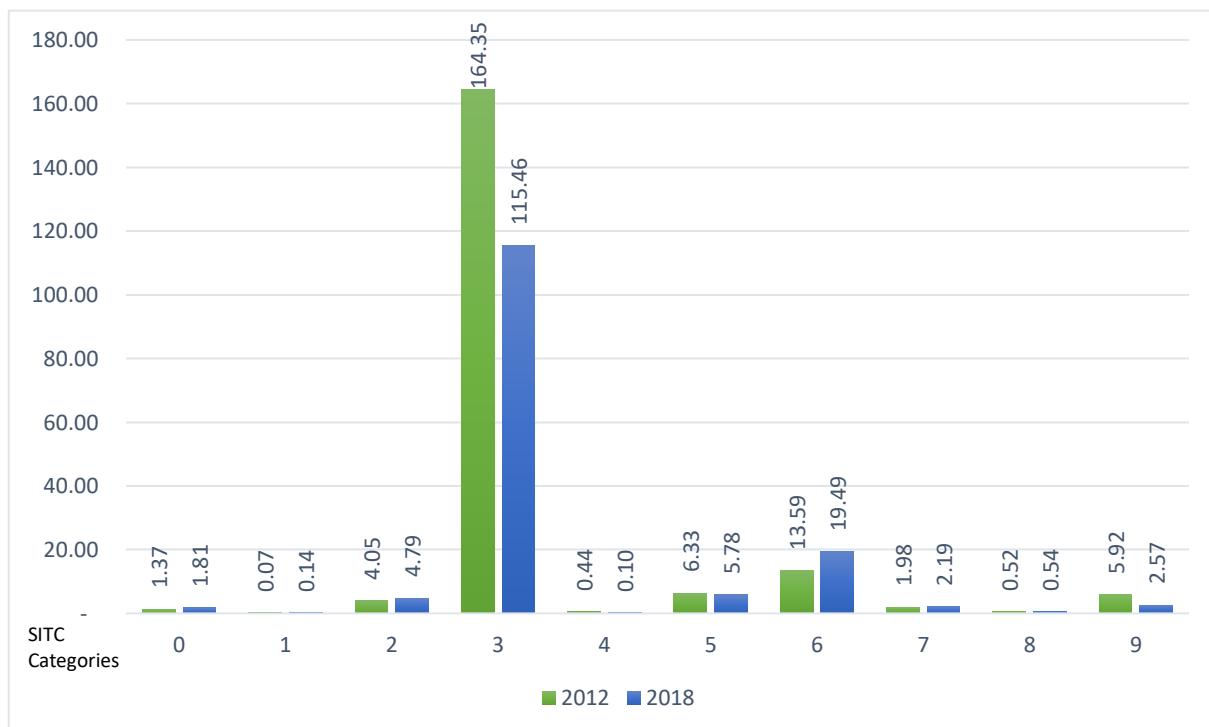


TABLE I-6
EU28 EXPORTS TO RUSSIA (B€)

<i>SITC</i> <i>Sections</i>	0	1	2	3	4	5	6	7	8	9
2012	8.31	1.60	1.73	1.40	0.53	19.60	12.71	61.29	14.69	1.02
2018	3.70	1.63	1.55	0.72	0.15	17.64	9.10	38.60	11.00	0.36
2018 - 2012	-5.00	0.00	0.00	-1.00	0.00	-2.00	-4.00	-23.00	-4.00	-1.00
Variation	-55.5%	1.8%	-10.7%	-48.5%	-71.7%	-10.0%	-28.4%	-37.0%	-25.1%	-64.2%

Data source: Eurostat

TABLE I-7
RUSSIAN EXPORTS TO EU28 (B€)

<i>SITC</i> <i>Sections</i>	0	1	2	3	4	5	6	7	8	9
2012	1.37	0.07	4.05	164.35	0.44	6.33	13.59	1.98	0.52	5.92
2018	1.81	0.14	4.79	115.46	0.10	5.78	19.49	2.19	0.54	2.57
2018 - 2012	0.44	0.07	0.74	-48.89	-0.34	-0.55	5.91	0.21	0.01	-3.36
Variation	31.8%	90.8%	18.2%	-29.8%	-77.8%	-8.7%	43.5%	10.4%	2.6%	-56.7%

Data source: Eurostat

However, since the Russian embargo was not targeting all European products, and as European sanctions were not targeting trade specifically, the only way to precisely know the share of products that decreased because of the embargo is to extract values of under-embargo products from the European Union total exports to Russia. To that end, database *EU_RU_XVToe_y* is used, and the variation rate of the EU total exports to Russia (reduced by under-sanction products) is calculated. This variation rate is equal to -29.30%, which is 1.81 pp lower than the variation of total European exports to Russia including under-embargo products (-31.11%). In consequence, it is clear that the bulk of the decrease of European exports to Russia is not directly due to the Russian embargo, since 94,18% of this decrease concerns products that are out of its range. Furthermore, the variation rate of under-embargo products exported to Russia from the European Union is -91.33%. We are therefore facing a strange fact, since in the frame of such embargo, this rate shall be equal to 100% (none of these products are supposed to enter in Russia). Next section will examine this deeper.

If only 5.82% of the decrease of European exports can directly be imputed to the implementation of the Russian embargo, one could wonder for which reasons trade decreased that much after all. It is possible that the rouble depreciation –due to the fall in oil price that happened simultaneously to sanctions– negatively

impacted Russian imports from the European Union. The logic would be that with a weaker currency, Russian economic actors slowed down their imports. It could make sense to believe so since Russian imports from the EU are mostly composed of high added-value products (machinery and transport equipment, chemicals, manufactured goods, *etc.*) Moreover, the Pearson correlation coefficient between the Russian rouble/Euro exchange rate and Russian imports reach -0.8228 ⁷³(period: 2012m1 to 2019m12). It indicates a strong downhill (negative) linear relationship. In other words, when the value of the rouble increase (depreciation), Russian imports from the EU decrease. Even if causality cannot be proven here, it seems highly likely that the decrease of European exports to Russia is due to the depreciation of the rouble.

It is also possible that economic actors didn't properly understand sanctions. Some might have stopped to export/import on a wrong basis. Small companies clearly don't have resources to properly examine legal texts (documents regarding the Russian embargo were published in Russian, no official translation provided). In a similar logic, private individuals might have been overreacting to sanctions. It could have been resulting either in changing their consumption behaviour because of the wrong understanding of sanctions (there aren't many people who would –for example– precisely know that meat of sheep or onions weren't included in the embargo), or in a willingness to stop buying European products because of international economic sanctions against Russia. The last point clearly follows the logic of political integration, as explained in this thesis' literature review, see [Galtung \(1967\)](#). As many Russians perceived European sanctions as an attack from the West, such scenario seems highly probable. A quite popular video supporting this way of thinking and titled “*Это Родина моя*” (“This is my country”) can be found here⁷⁴. It is an answer to international sanctions against Russia.

⁷³ Period: 2012m1 to 2019m12. Data source: ECB reference exchange rate, Russian rouble/Euro, average observations through period; Eurostat, EU trade since 1988 by SITC (DS-018995).

⁷⁴ <https://www.youtube.com/watch?v=uHsjrcOoHkM>

4.3 A Partially Implemented Embargo

As explained earlier, some goods targeted by the Russian embargo have still been exported to Russia after the implementation of the embargo. Under-embargo goods can be summed up in 16 subsections (Table I-8). In Graph I-5, it is easy to see that our database can be split in two periods (before and during the embargo implementation). Indeed, it is clear that exports of under-embargo products to Russia collapsed after August 2014. Using Graph I-6, it also seems easy to see that under-embargo products were still imported in Russia from the European Union. Regarding descriptive statistics, the average variation rate of these subsections between 2012 and 2018 is -92.08%⁷⁵, confirming that the embargo is partially applied (it shall be equal to -100%). Moreover, there are inequalities between subsections regarding the application of the embargo. For example, if the ban of meat of bovine animals or butter is almost entirely respected, the ban on fermented beverages and crustaceans is not (there is even an increase, see Table I-9). Between 2012 and 2018, trade of under-embargo products fell by 3.3 billion €. It is, however, important to be careful about this result, since there might have been some decrease in the export of these products between 2012 and mid-2014. Consequently, it seems more rational to focus on monthly growth rate (Table I-9).

The average month-on-month growth rate of all subsections during the witness period is 1755.9%, and 828.31% during the test period (see Table I-9). At first glance, it seems that the over month growth dynamic has been divided by more than two. Yet, consulting subsections one by one leads to the fact that most under-embargo products have a greater over month growth during the embargo, than before the embargo. Half of the products targeted by the Russian embargo see their over month growth rate (during the test period) being greater than 94.5%. It doesn't mean that the trade of these products is higher in value during the embargo, but it seems to indicate that there is much more volatility in data. Bigger over month growth rates here are explained by the high number of "0" or "." (missing values) in data covering the embargo.

⁷⁵ The value -91.33% was calculated earlier with yearly values, -91.318% is found with monthly data.

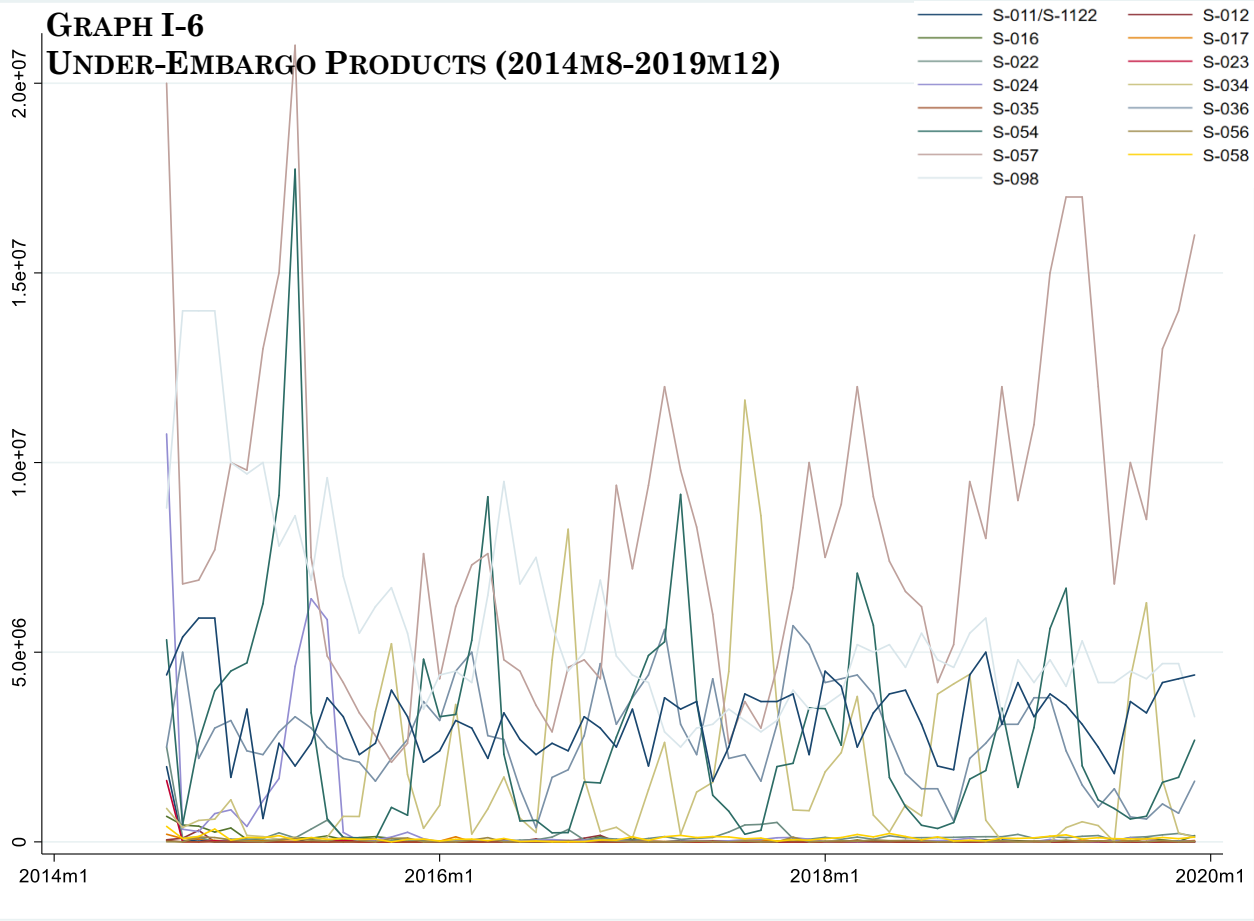
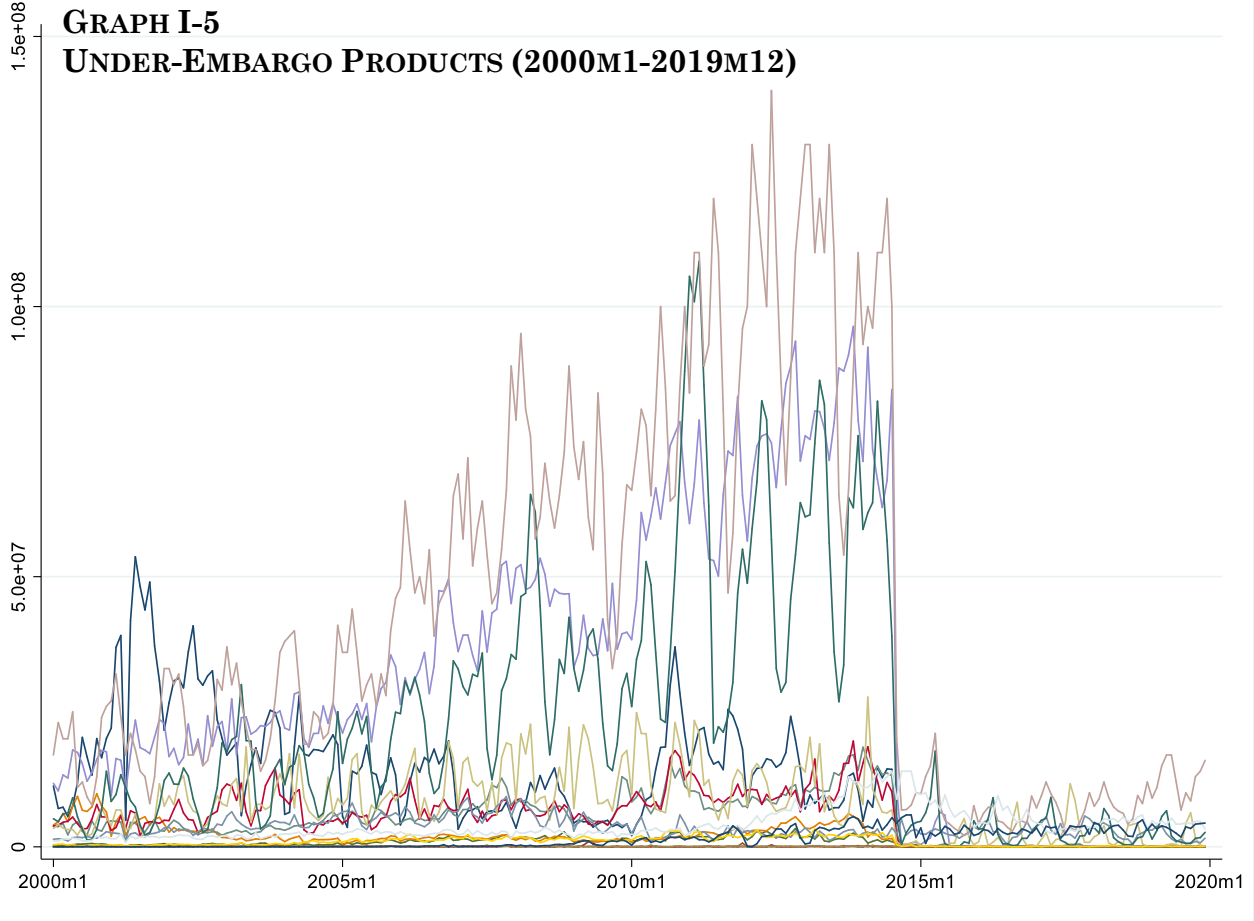
TABLE I-8
UNDER-EMBARGO GOODS BY SUBSECTION

<i>Subsection No.</i>	<i>Title</i>
011	MEAT OF BOVINE ANIMALS
012	OTHER MEAT AND EDIBLE MEAT OFFAL
016	MEAT AND EDIBLE MEAT OFFAL, SALTED, IN BRINE, DRIED
017	MEAT AND EDIBLE MEAT OFFAL, PREPARED OR PRESERVED
022	MILK AND CREAM AND MILK PRODUCTS
023	BUTTER AND OTHER FATS DERIVED FROM MILK
024	CHEESE AND CURD
034	FISH, FRESH (LIVE OR DEAD), CHILLED OR FROZEN
035	FISH, DRIED, SALTED OR IN BRINE; SMOKED FISH
036	CRUSTACEANS, MOLLUSCS AND AQUATIC INVERTEBRATES
054	VEGETABLES, FRESH, CHILLED, FROZEN OR SIMPLY PRESERVED
056	VEGETABLES, ROOTS AND TUBERS, PREPARED OR PRESERVED
057	FRUIT AND NUTS (NOT INCLUDING OIL NUTS), FRESH OR DRIED
058	FRUIT, PRESERVED, AND FRUIT PREPARATIONS
098	EDIBLE PRODUCTS AND PREPARATIONS
1122	FERMENTED BEVERAGES

TABLE I-9
UNDER-EMBARGO PRODUCTS,
MONTH-ON-MONTH GROWTH RATES

<i>Subsection</i>	<i>Mean</i> <i>(2010m9-2015m8)</i>	<i>Mean</i> <i>(2014m9-2018m8)</i>
011	1.7%	139.2%
012	27874.4%	160.2%
016	2.9%	9406.2%
017	0.0%	627.5%
022	-1.0%	538.2%
023	0.1%	201.9%
024	-0.7%	98.1%
034	9.6%	136.1%
035	78.4%	21.5%
036	8.0%	8.7%
054	2.5%	69.6%
056	43.3%	1737.9%
057	1.4%	6.5%
058	0.6%	90.8%
098	3.8%	0.0%
1122	69.3%	10.6%
<i>Mean</i>	<i>1755.9%</i>	<i>828.3%</i>

Data source: Eurostat



However, the total value of under-embargo exported goods between 2010m9 and 2014m8 is 14.15b€, while the value between 2014m9 and 2018m8 is 13.06b€ (see Table I-10). It is now rational to say that exports of under-embargo goods to Russia from the European Union were not greatly impacted, since they decrease only by -7.65% between periods (-1.08b€).

TABLE I-10
UNDER-EMBARGO PRODUCTS, VALUE IN MILLION€

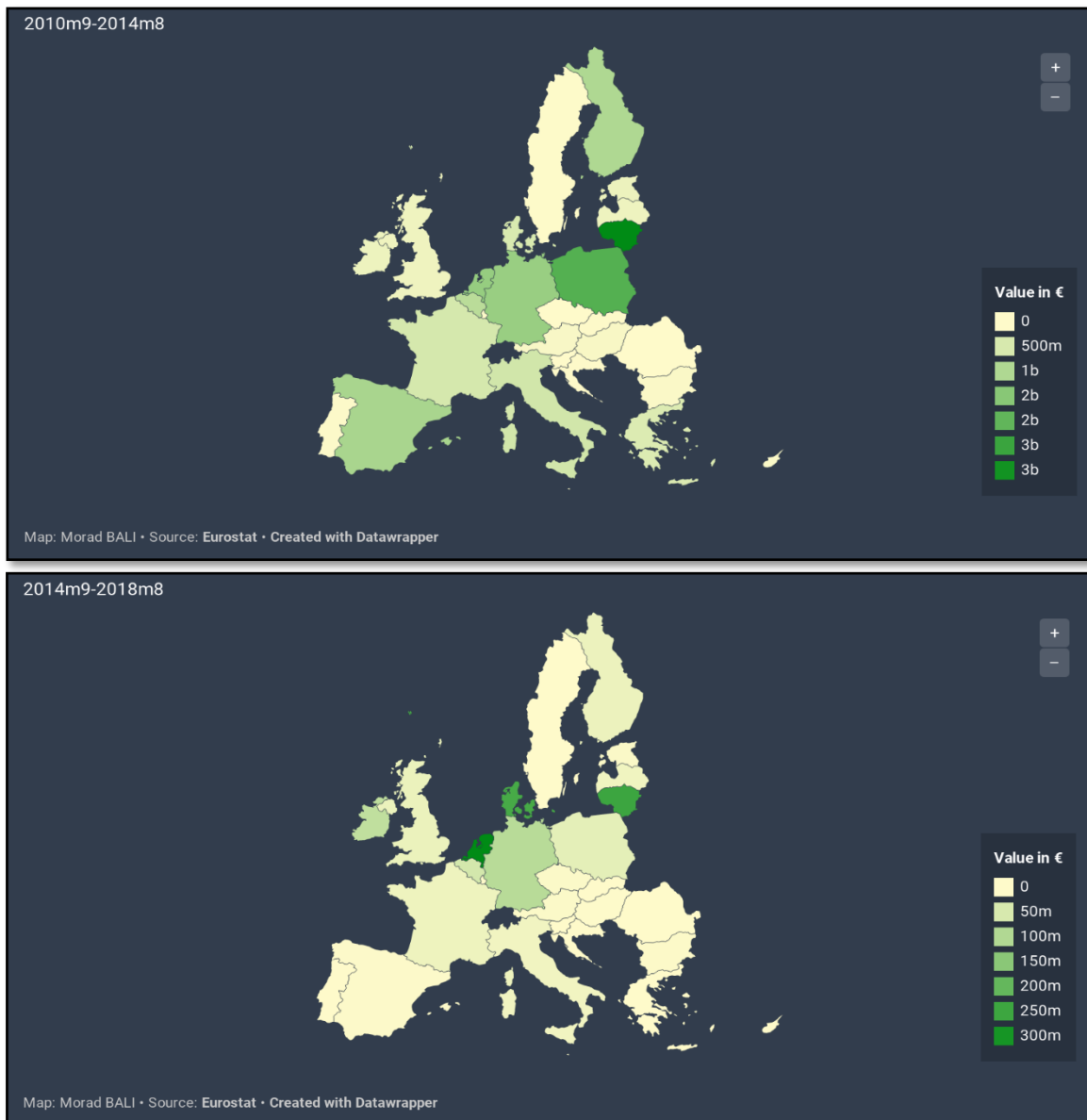
<i>Subsection</i>	<i>2010m9- 2014m8</i>	<i>2014m9- 2018m8</i>	<i>Difference</i>	<i>Variation</i>
011	722.30	605.94	-116.36	-16.11%
012	1.68	2.11	0.43	25.57%
016	89.79	81.76	-8.03	-8.94%
017	154.75	147.63	-7.11	-4.60%
022	518.49	464.55	-53.94	-10.40%
023	536.80	473.50	-63.30	-11.79%
024	3 506.40	3 211.65	-294.76	-8.41%
034	540.92	475.85	-65.07	-12.03%
035	3.19	3.10	-0.09	-2.78%
036	124.40	122.80	-1.60	-1.29%
054	2 735.23	2 502.31	-232.93	-8.52%
056	5.27	5.17	-0.10	-1.90%
057	4 645.00	4 362.40	-282.60	-6.08%
058	100.71	90.54	-10.17	-10.10%
098	336.60	376.80	40.20	11.94%
1122	130.14	142.44	12.30	9.45%
Total	14 151.68	13 068.55	-1 083.13	-7.65%

Data source: Eurostat

Previous results were examining under-embargo goods exported to Russia from all countries of the European Union (28). This analysis is still weak by itself since there might be great disparities between countries. For this reason, data of each EU25 country have been compiled. Following the same logic as before, per country trade between a witness period (2010m9 to 2014m8) and a test period (2014m9 to 2018m8) is observed. Map I01 clearly shows inequalities in the implementation of the Russian embargo among countries of the European Union. Lithuania (first in the ranking), the Netherlands (third), Germany (fourth), Belgium (seventh), and some others who were top exporters of under-embargo products during the witness period, remain in a great position during the test period (the Netherlands is now first, Lithuania is second, Germany remains fourth, and Belgium is sixth). This means that if the total value of goods exported decreased, the overall structure of

trade is similar. Reversely, some countries have lost their place, among which is Poland (second to seven in the ranking) or Spain (five to seventeen). What is lost by one is being won by another, and some countries such as Denmark increased their position (from ten to three).

MAP I05
EXPORTS OF UNDER-EMBARGO PRODUCTS TO RUSSIA



From another perspective, it is also interesting to weight the share of each period on the total. In order to fit results of “3.4 Country Analysis”, it has been decided to extend the test period until 2019m12, and to start the witness period in 2009m5. Table I-11 and Chart I-1 represent the share of under-embargo goods which were

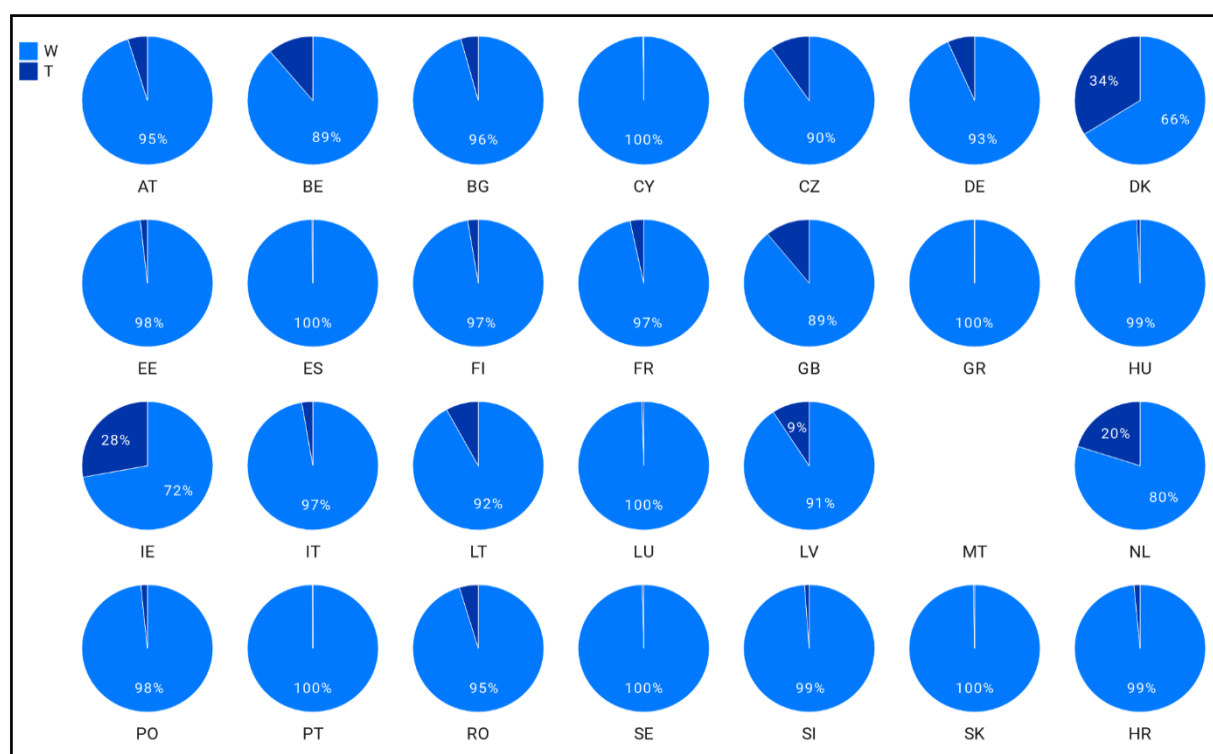
exported to Russia during the embargo (test period) compared to the total of under-embargo goods exported to Russia during the entire period (witness period + test period). For example, between 2009m5 and 2019m12 (entire period), Greece exported under-embargo goods for a total of 497.4m€. Yet, between 2014m9 and 2019m12, this value reaches only 156 186€. It means that 99.97% of Greece's exports of under-embargo products to Russia happened before the embargo. Thus, it seems that Greece respected Russian restrictions relatively well.

TABLE I-11
RANKING – SHARE OF THE TEST PERIOD ON THE TOTAL PERIOD,
UNDER-EMBARGO PRODUCTS

<i>Countries</i>	DK	IE	NL	BE	GB	CZ	LV	LT	DE
<i>Share</i>	33.8%	27.9%	20.1%	11.2%	11.0%	9.8%	9.2%	8.1%	6.7%
<i>Countries</i>	AT	RO	BG	FR	IT	FI	EE	PO	HR
<i>Share</i>	4.8%	4.7%	4.3%	3.3%	2.7%	2.6%	1.7%	1.6%	1.5%
<i>Countries</i>	SI	HU	LU	SE	SK	ES	CY	PT	GR
<i>Share</i>	1.2%	0.8%	0.4%	0.3%	0.3%	0.2%	0.2%	0.1%	0.0%

Note: As Malta didn't export under-embargo goods to Russia between 2009m5 and 2012m12, it can't be included in this table.

CHART I-1
SHARE OF THE TEST PERIOD ON THE TOTAL PERIOD,
UNDER-EMBARGO PRODUCTS



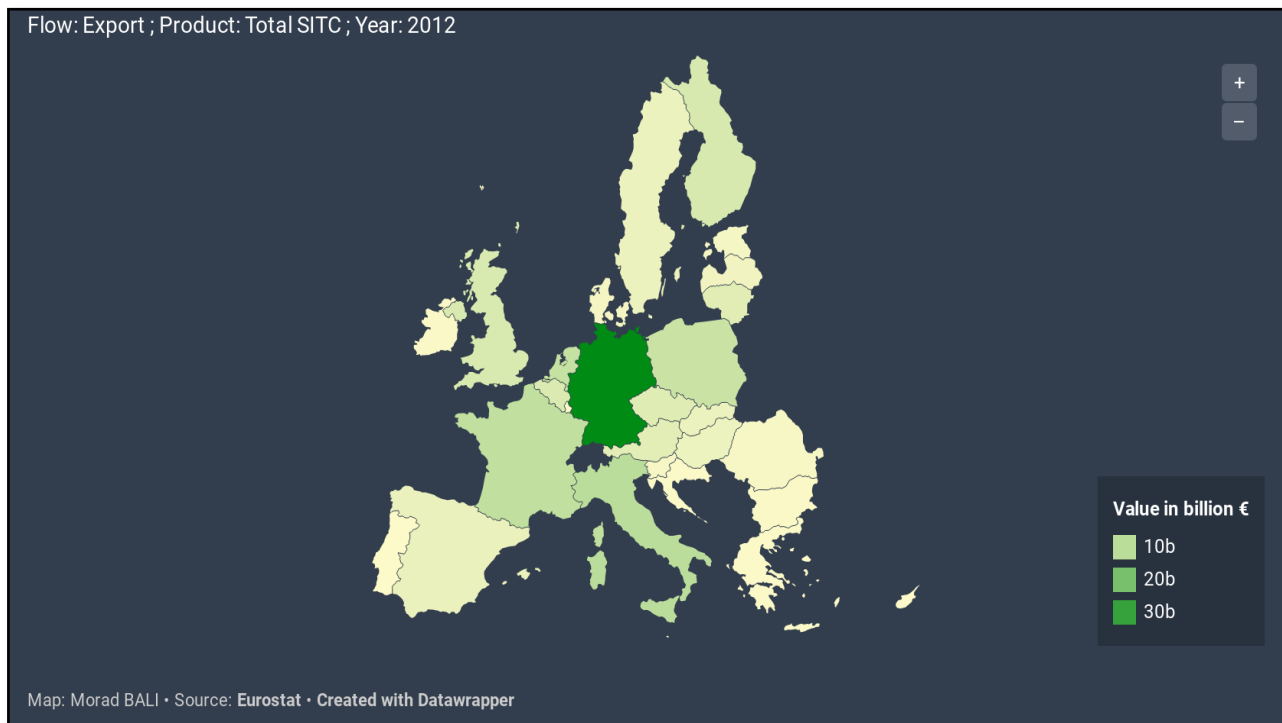
Note: W refers to the witness period (2009m5 to 2014m8), T refers to the test period (2014m9 to 2019m12). Malta is still missing as it didn't export under-embargo goods to Russia.

More than one third of Denmark exports of under-embargo products takes place during the embargo. Similarly, Ireland (27.9%), the Netherlands (20.1%), Belgium (11.2%), the United Kingdom (11%), and the Czech Republic (9.8%) significantly overrode the embargo. Many other countries have a positive value (see Table I-11), and none entirely stopped to export under-embargo goods to Russia since the embargo's implementation (even Greece remains at 0.03%, 156 186€ in total value). Further details are provided in “3.4 Country Analysis”, and values of under-embargo products exported during the embargo are detailed in Annexes, [Table I-17](#).

5. Country Analysis

Countries of the European Union are not equal in their trade relationship with Russia. The ranking of these countries depends on the value of their exports to Russia leads to Map I02.

MAP I06
EU EXPORTS TO RUSSIA



As we can see, Germany is leading. Indeed, with a total of 37.9b€ exported to Russia in 2012, Germany represents by itself almost a third of the total trade between the European Union and Russia. At the second place comes Italy with 9.9b€, then comes France (9.1b€), the Netherlands (8.3b€), Poland (7.7b€), and Finland (5.6b€). These six account for 63.85% of the total exports to Russia. One can naturally wonder if this ranking changed between 2012 and 2019. The fact is that Germany still leads and is followed by Italy. Poland is now third, followed by the Netherlands which registers a 1.2b€ decrease in its exports value. France was hardly hit and lost two places, after a fall of 3.5b€ in its exports value. Similarly, Finland exports decrease by 2b€. Lithuania, Belgium and the Czech Republic do not see their total exports to Russia moving much, but they get a better place because of others' fall. Thus, in 2019, the six greatest trade partners of Russia are Germany, Italy, Poland, the Netherlands, France and Lithuania (for 64.85% of total exports to Russia).

5.1 The Ten Greatest European Exporters to Russia

In both 2012 and 2019, the same countries can be found in the top 10 (even if at different places). In 2012, they account for 80% of the trade with Russia (among the EU); 80.92% in 2019. Thus, these countries are the main trading partners of Russia among the EU. For this very reason, our analysis will be aimed at them.

Table I-12
Total Exports to Russia

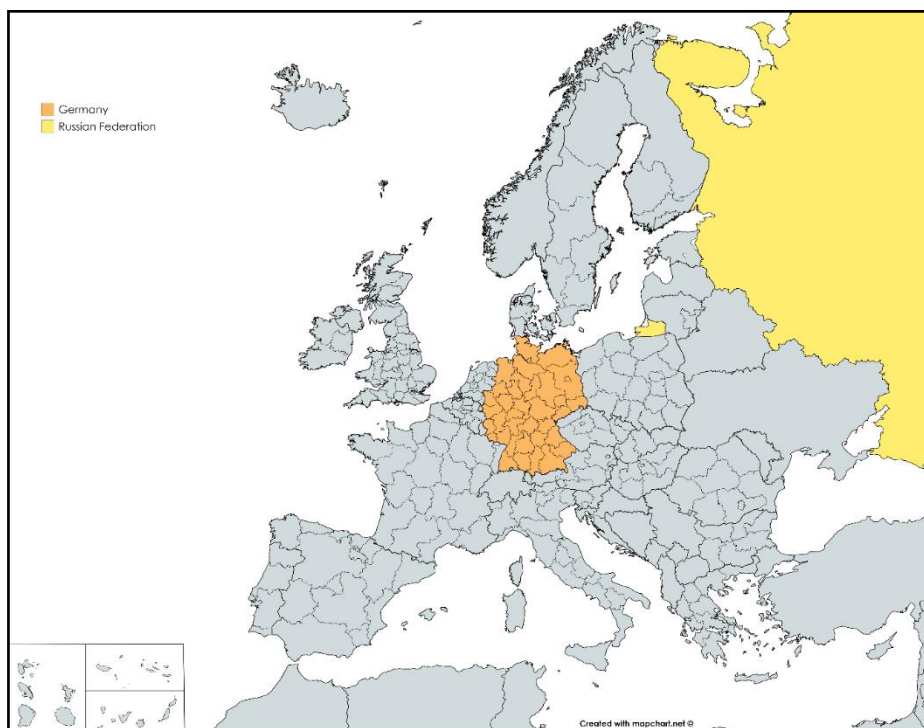
<i>Country (2012)</i>	<i>Value (m€)</i>	<i>Share</i>	<i>Country (2019)</i>	<i>Value (m€)</i>	<i>Share</i>
Germany	37 976	30.75%	Germany	26 658	29.36%
Italy	9 979	8.08%	Italy	7 918	8.72%
France	9 145	7.40%	Poland	7 435	8.19%
The Netherlands	8 348	6.76%	The Netherlands	7 103	7.82%
Poland	7 724	6.25%	France	5 629	6.20%
Finland	5 688	4.61%	Lithuania	4 143	4.56%
The United Kingdom	5 574	4.51%	Belgium	4 139	4.56%
Belgium	5 419	4.39%	The Czech Republic	3 797	4.18%
The Czech Republic	4 696	3.80%	Finland	3 652	4.02%
Lithuania	4 355	3.53%	The United Kingdom	2 999	3.30%
Austria	4 059	3.29%	Austria	2 374	2.62%
Spain	2 951	2.39%	Sweden	2 067	2.28%
Sweden	2 716	2.20%	Spain	2 054	2.26%

Slovakia	2 675	2.17%	Latvia	1 972	2.17%
Hungary	2 565	2.08%	Hungary	1 785	1.97%
Latvia	1 969	1.59%	Slovakia	1 451	1.60%
Denmark	1 572	1.27%	Romania	1 015	1.12%
Estonia	1 512	1.22%	Denmark	965	1.06%
Slovenia	1 151	0.93%	Slovenia	887	0.98%
Romania	1 050	0.85%	Estonia	867	0.95%
Ireland	600	0.49%	Ireland	611	0.67%
Bulgaria	563	0.46%	Bulgaria	522	0.57%
Greece	462	0.37%	Greece	209	0.23%
Croatia	331	0.27%	Portugal	194	0.21%
Luxembourg	189	0.15%	Luxembourg	169	0.19%
Portugal	182	0.15%	Croatia	155	0.17%
Malta	36	0.03%	Cyprus	26	0.03%
Cyprus	19	0.02%	Malta	6	0.01%
Total EU28	123 506	100.00%	Total EU28	90 799	100.00%

Data source: Eurostat

5.1.1 Germany

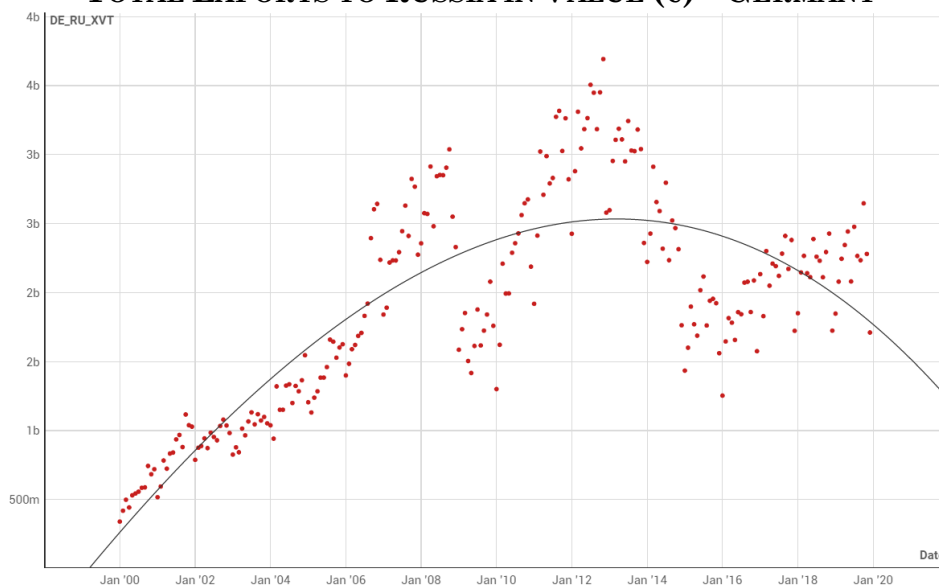
MAP I07
EUROPE MAP – GERMANY AND RUSSIA



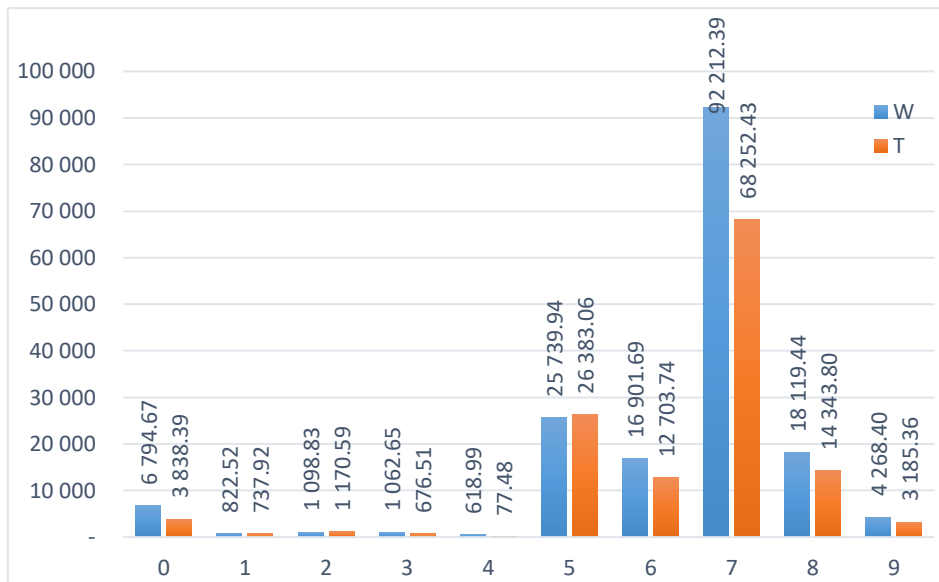
Germany is the first economy of the European Union. During the witness period, it accounted for 30.49% of the European Union total exports to Russia. Even during the test period, the country was still leading with a share of 29.61%. However, between these two periods, Germany's exports to Russia decreased by -22.4% (-37.8b€). The trade balance between Russia and Germany is slightly lower during

the embargo (-20.05b€wp, -21.95b€tp), which is mostly explained by the fact that exports decreased more than imports (-19.0%, 35.90b€) between periods. Additionally, exports of under-embargo products decreased by -92.8% (-1.54b€). Indeed, the country kept exporting forbidden goods after the embargo implementation, for a total value of 120 m€. By doing so, Germany takes the fifth place in the embargo violators ranking. From another perspective, Graph I-7 reveals that the Ukrainian crisis and all related exogenous events had at least as much effect on Germany's exports to Russia than the financial crisis of 2009. Nonetheless, the country's exports structure didn't change much between periods. Indeed, the leading export section fell by -25.98% (-23.95b€) but remains Machinery and Transport Equipment (76.10b€wp, 68.25b€tp), followed by Chemicals and Related Products (25.73b€wp, 26.38b€tp) and Manufactured Goods (further details in Annexes, [Table I-13](#)). The share of trade with Russia in Germany's total exports to the world decreased by -0.66 pp and reached the value of 2.42% (3.08%wp). The value is even lower regarding the share of under-embargo products in Germany's total trade to Russia (0.99%wp, 0.09%tp).

GRAPH I-7
TOTAL EXPORTS TO RUSSIA IN VALUE (€) – GERMANY

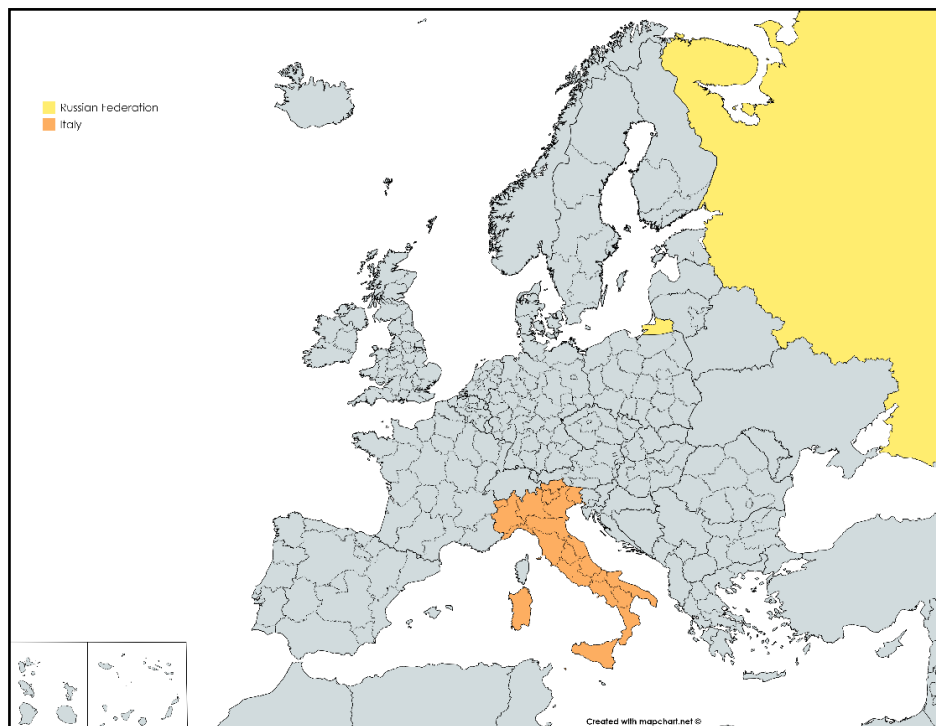


GRAPH I-8
EXPORTS (M€) TO RUSSIA PER SITC SECTIONS AND PER PERIODS – GERMANY



5.1.2 Italy

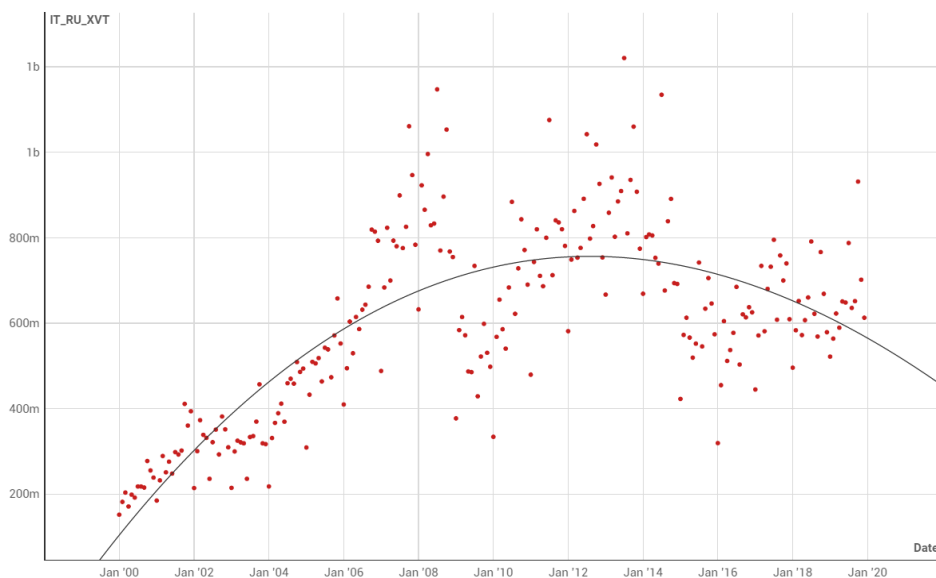
MAP I08
EUROPE MAP – ITALY AND RUSSIA



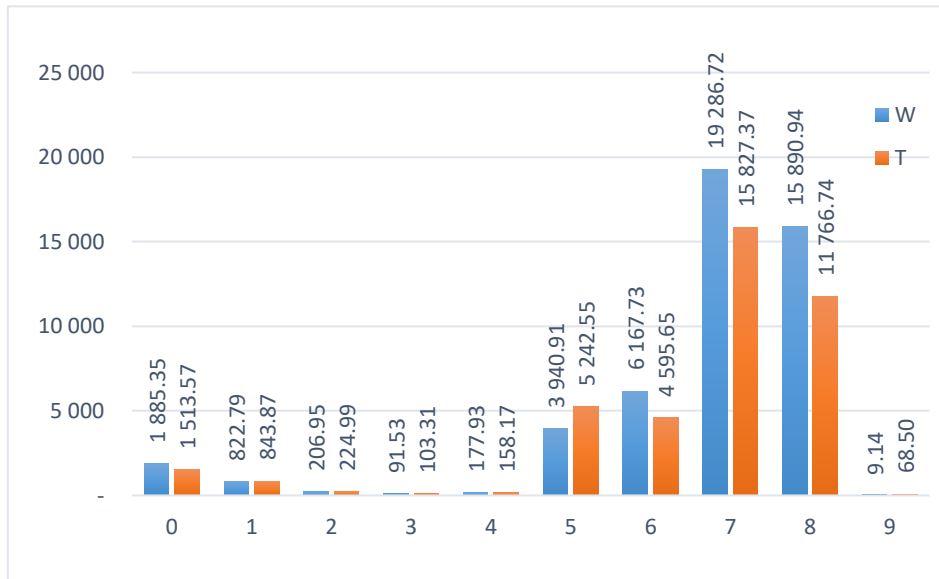
Italy is the fourth economy of the European Union. The country accounted for 8.68% of the EU total exports to Russia during the witness period, and for 9.14%

during the test period. It is the second greatest exporter to Russia among European countries (see Annexes, [Table I-14](#)). Italy's total exports to Russia in percentage decreased by -17.1% (-8.29b€) between periods. Exports of under-embargo products decreased by -97.2% (-693 m€). As for Germany, forbidden goods were still exported to Russia during the embargo, for a total value of 20 m€ (six times less than Germany). Thus, Italy obtains the twelfth place in the embargo violators ranking. Similarly to Germany, the decrease in Italy's exports to Russia is at the very least similar to the decrease triggered by the economic crisis of 2009. Regarding the trade structure, there are no major changes between periods. The leading export section is Machinery and Transport Equipment (19.28b€wp, 15.82b€tp), which decreased by -17.94% (-3.45b€). It is closely followed by Miscellaneous Manufactured Articles (15.89b€wp, 11.76b€tp) that decreased by -25.95% (-4.12b€). Moreover, there was a consequent leap forward in the exports of Chemicals and Related Products with an increase of +33.0% (+1.30b€) between periods (3.94b€wp, 5.24b€tp). The share of trade with Russia in Italy's total exports to the world decreased by -0.36 pp (2.49%wp, 2.13%tp). Finally, exports of under-embargo products represent only 1.47% of Italy's total exports to Russia during the witness period (0.05%tp).

GRAPH I-9
TOTAL EXPORTS TO RUSSIA IN VALUE (€) – ITALY

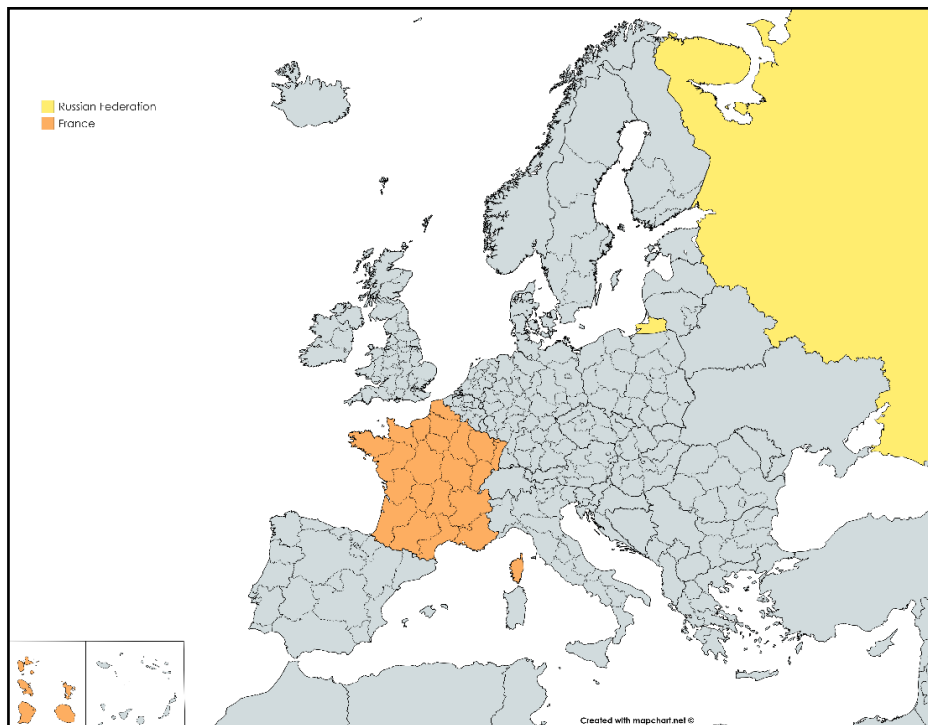


GRAPH I-10
EXPORTS (M€) TO RUSSIA PER SITC SECTIONS AND PER PERIODS – ITALY



5.1.3 France

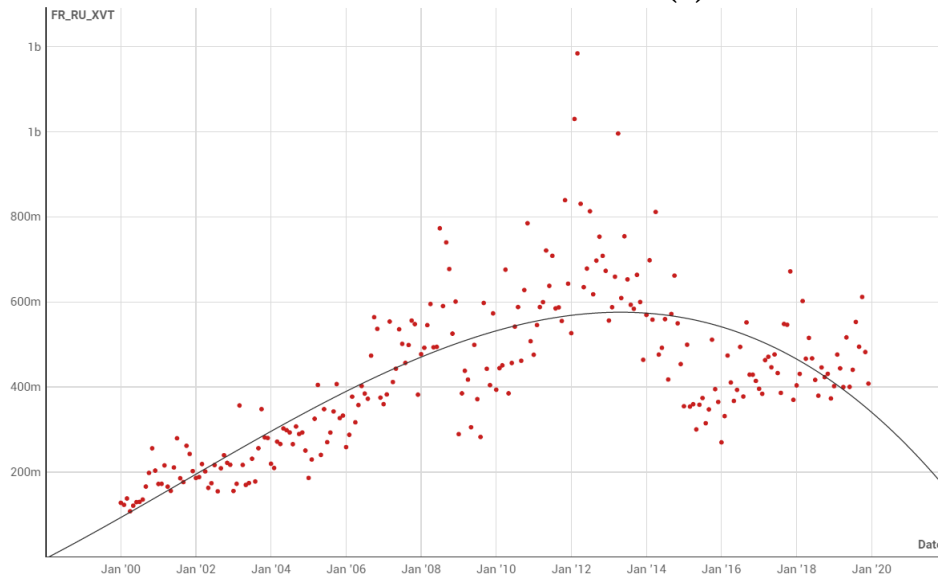
MAP I09
EUROPE MAP – FRANCE AND RUSSIA



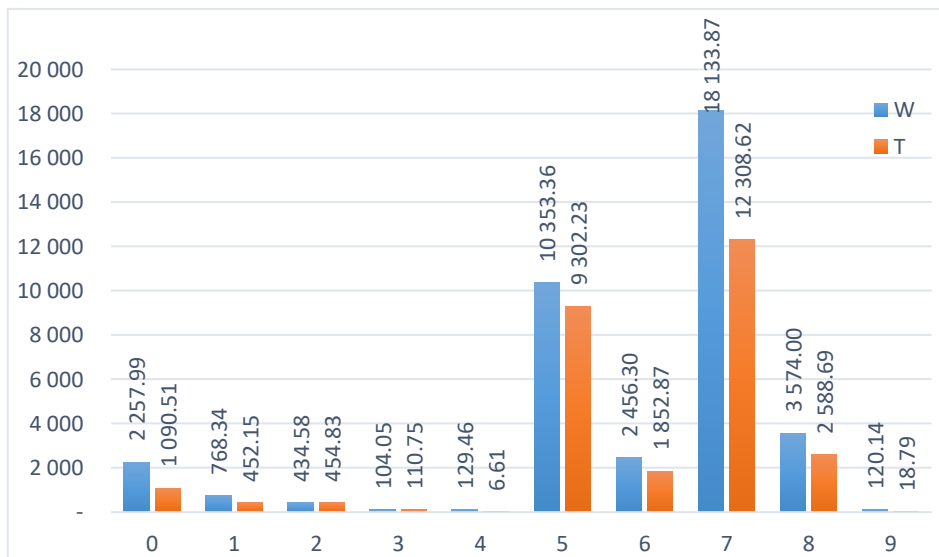
France is the third economy of the EU, and the third greatest exporter to Russia during the witness period –its share in the European Union total exports to Russia stands at 7.01%wp, 6.41%tp. Its total exports to Russia decreased by -26.9% (-10.43b€), which is the second greatest decrease among the 10 greatest trade partners of Russia (-96.5% or -629 m€ for under-embargo products). As Germany and Italy, France kept exporting forbidden goods to Russia for a total value of 23 m€. It puts the country right before Italy in the embargo violators ranking. Similarly to Germany and Italy, France exports to Russia observed a bigger decrease than during the 2009 economic crisis. This is perfectly illustrated by the cubic trend line that shows a real fracture from 2014 (Graph I-11).

The leading export section remains Machinery and Transport Equipment (18.13b€wp, 12.30b€tp), but decreased by -32.12% (-5.82b€) between periods. The second greatest export section is Chemicals and Related Products. It also decreased between periods (10.35b€wp, 9.30b€tp) for a total additional value of -1.05b€ (-10.15%). Thus, the structure of exports doesn't reveal any drastic changes between periods, except that the first and second leading export section get much closer during the test period. The country's trade balance (total exports to Russia) appreciates greatly between periods (-21.89b€wp, -10.61b€tp). This is mostly due to a lower decrease in exports to Russia (-26.9%) than the decrease in imports (-38.8%). As for other countries, the share of trade with Russia in France's total trade is quite low (1.74%wp, 1.39%tp), and the share of under-embargo products in France's exports to Russia is tiny (1.68%wp, 0.08%tp).

GRAPH I-11
TOTAL EXPORTS TO RUSSIA IN VALUE (€) – FRANCE

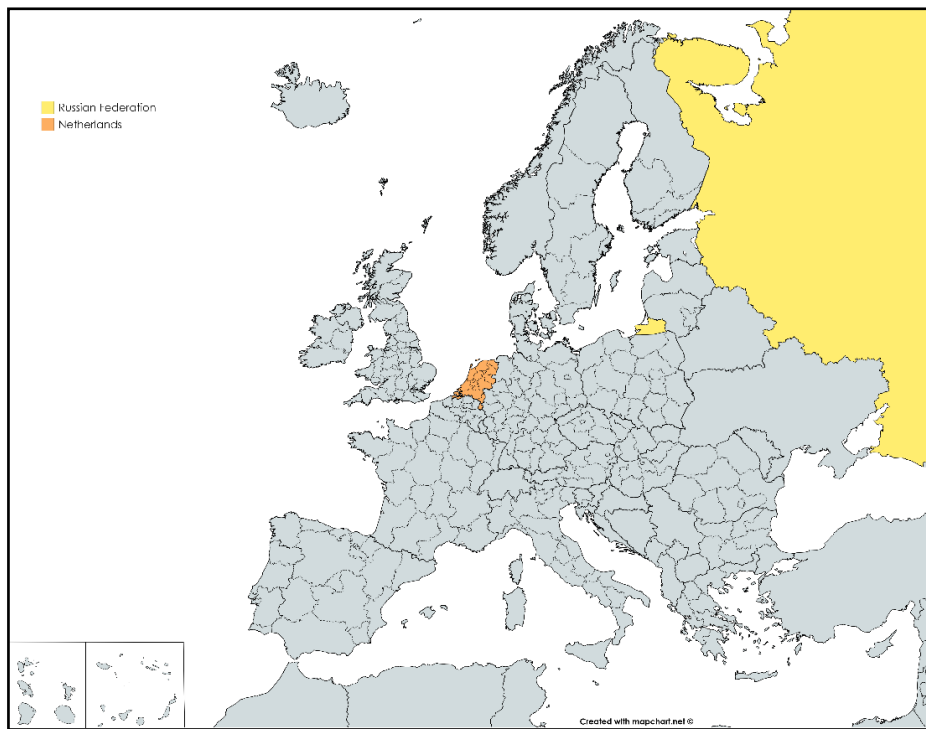


GRAPH I-12
EXPORTS (M€) TO RUSSIA PER SITC SECTIONS AND PER PERIODS – FRANCE



5.1.4 *The Netherlands*

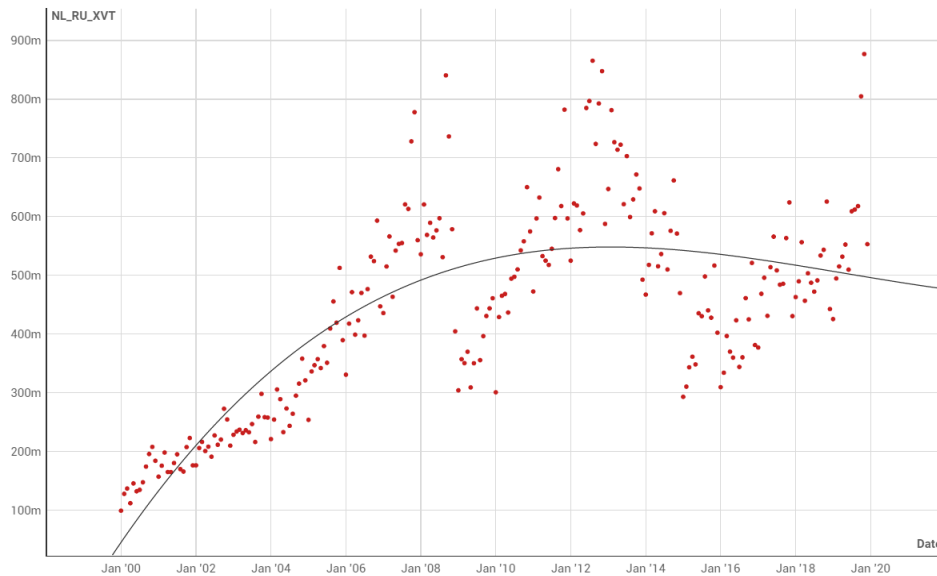
MAP I10
EUROPE MAP – THE NETHERLANDS AND RUSSIA



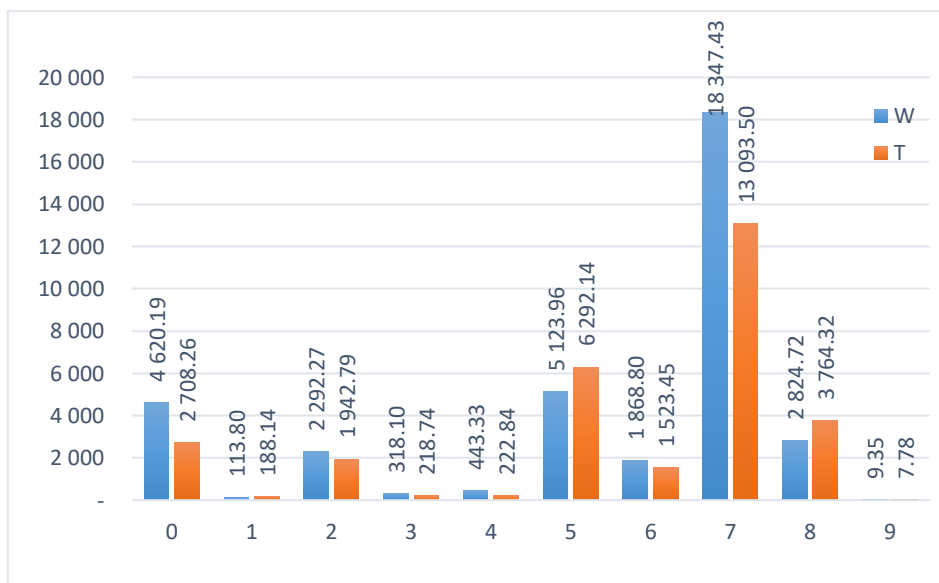
The Netherlands is the sixth economy of the European Union and the fourth greatest European exporter to Russia. Its share in the EU total exports to Russia was 6.67% during the witness period, and 7.00% during the test period. Its total exports to Russia decreased by -16.2% between periods (-5.96b€ in value), while under-embargo products decreased by -74.9% (-1.31bm€). Thus, the Netherlands kept exporting under-embargo goods during the test period, for a total value of 442 m€. By doing so, the country reached the first place in the embargo violators ranking. Its total exports to Russia also decreased as much as during the 2009 economic crisis, but the cubic trend line reveals that they aim to return to normal. As for previous countries, its leading export section is Machinery and Transport Equipment (18.34b€wp, 13.09b€tp); it decreased by -28.64% (-5.25b€) between periods. Chemicals and Related Products increased between periods for a total value of 1.16b€ (+22.8%). Unsurprisingly, the share of exports to Russia in its total trade to the world is also very low (1.47%wp, 1.18%tp). Yet, contrarily to Germany, Italy, and France, the share of under-embargo products in its total exports to

Russia isn't that insignificant (4.77%wp, 1.43%tp). Thus, the Netherlands has a greater dependency on trade with Russia than other countries studied before.

GRAPH I-13
TOTAL EXPORTS TO RUSSIA IN VALUE (€) – THE NETHERLANDS

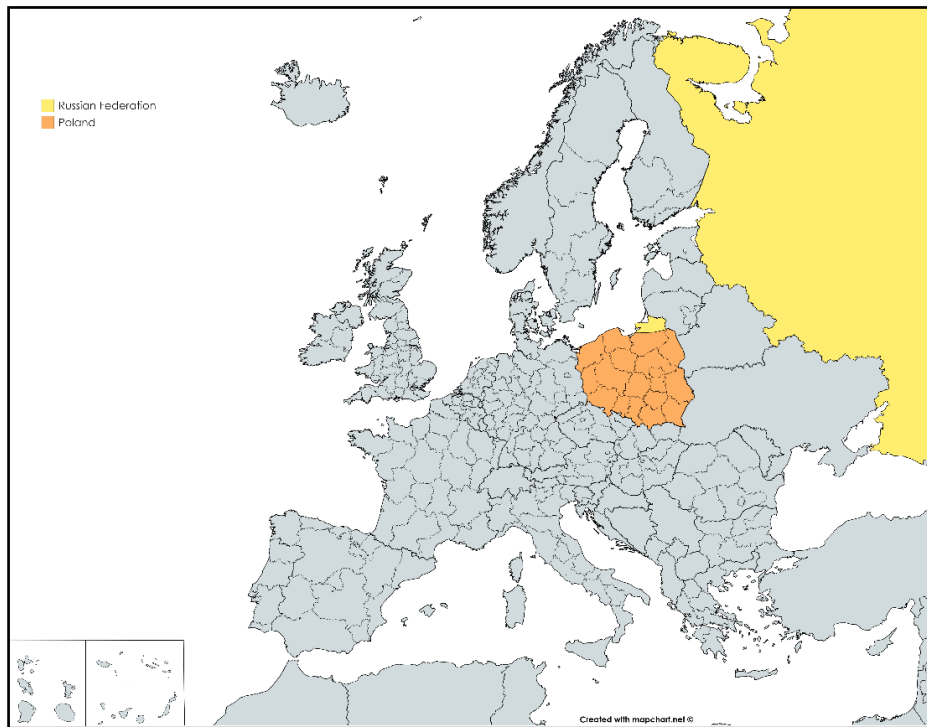


GRAPH I-14
EXPORTS (M€) TO RUSSIA PER SITC SECTIONS AND PER PERIODS – THE NETHERLANDS



5.1.5 Poland

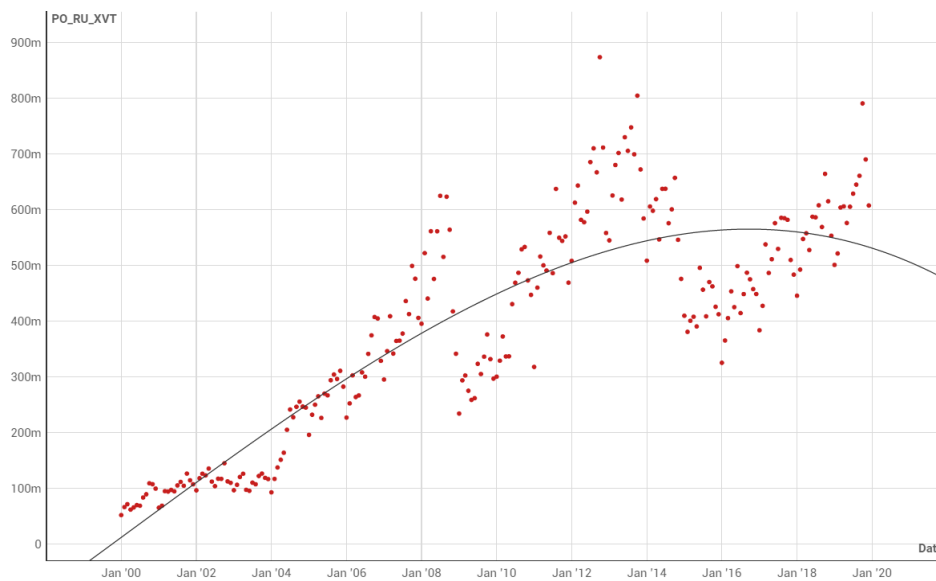
MAP I11
EUROPE MAP – POLAND AND RUSSIA



Poland is the seventh economy of the EU. It accounts for 6.18% of EU28 total exports to Russia during the witness period (7.47%tp), and it is the fifth greatest exporter to Russia among the EU. Poland's total exports to Russia between periods decreased by -3.5% (-1.19b€), and under-embargo products decreased by -98.4% (-2.50b€). The country was the second greatest exporter of under-embargo goods during the witness period, right after Lithuania. As for others, exports of forbidden products kept going during the embargo (for a total value of 42 m€). Thus, Poland takes the seventh place in the embargo violators ranking. Its total exports to Russia are on a different path than others. The economic crisis of 2009 doesn't seem to have had such an important impact, and if it is true that the Ukrainian crisis reveals a clear rupture, the point cloud keeps increasing through time. This is perfectly shown by the cubic trend line's increase, which doesn't seem to collapse much after 2014. The overall structure of trade didn't change much. Machinery and transport equipment is leading, increasing by 1.2% (156 m€) between periods. Chemicals and related products increase by 27.8% (1.51b€) and become the second leading section during the test period. Crude materials have the greatest increase

(83.81%, 195 m€) even if they remain a small exporting area. Furthermore, Poland's trade balance in both periods is negative (-55.93b€wp, -38.06b€tp). Nevertheless, it is important to note that the share of exports to Russia in its total exports to the world lost -1.05 pp between periods (4.68%wp, 3.63%tp). Finally, Poland's decrease in its share of under-embargo products in its total exports to Russia is the second biggest of our top 10 during the witness period (7.45%wp, 0.13%tp). It is possible that what was previously exported to Russia reached other countries, particularly since an increase in Russophobia⁷⁶ was observed in Poland, closely followed by consequent political changes⁷⁷.

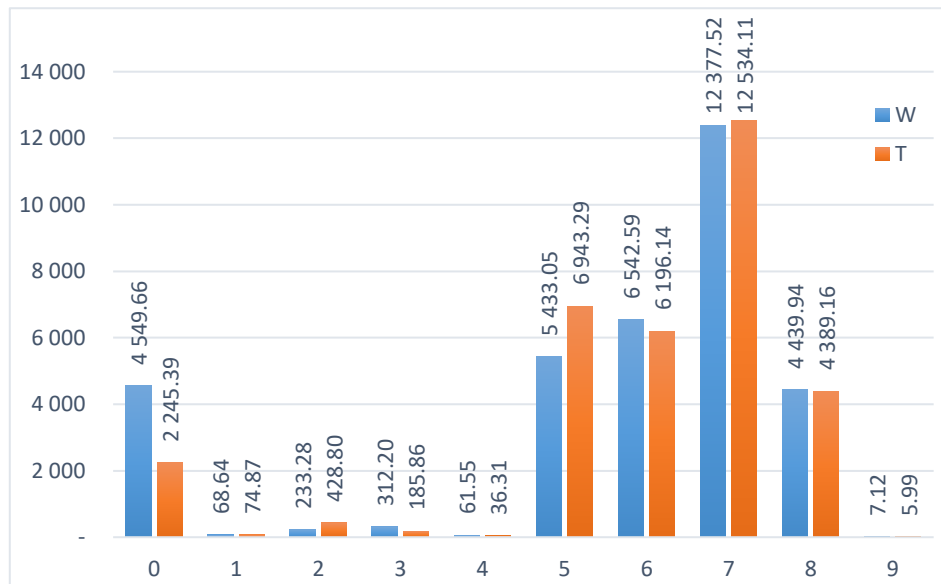
GRAPH I-15
TOTAL EXPORTS TO RUSSIA IN VALUE (€) – POLAND



⁷⁶<https://www.rt.com/news/398135-warsaw-russophobia-museum-renovation/> and <https://www.rt.com/op-ed/404313-poland-destroys-monuments-soviet-russia/>

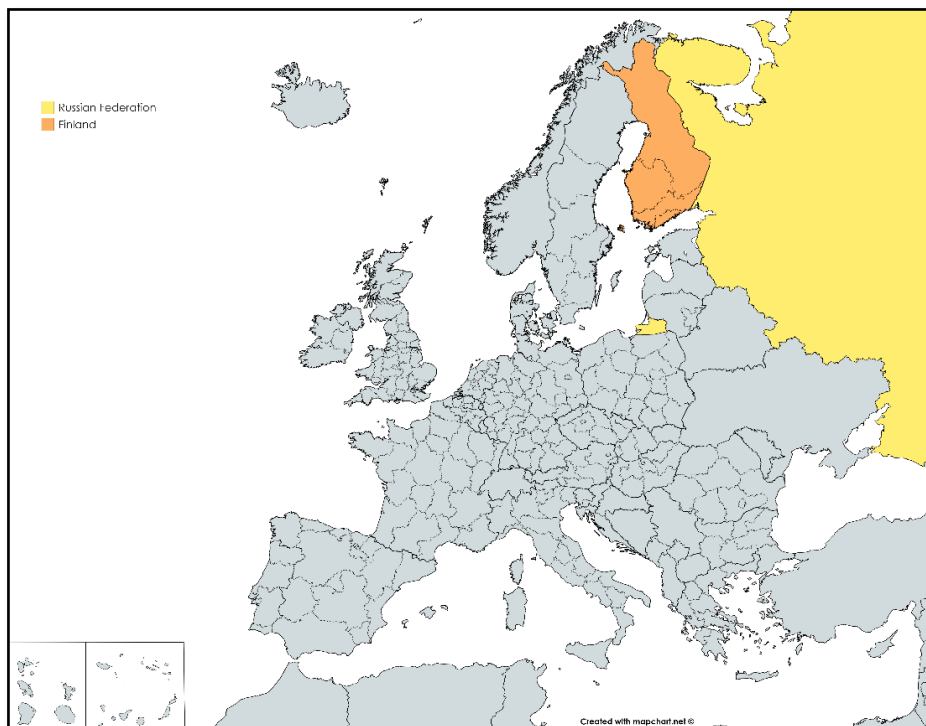
⁷⁷ Election of the opposition Law and Justice (PiS) candidate Andrzej Sebastian Duda (National-conservative, christian democratic, right-wing populist).

GRAPH I-16
EXPORTS (M€) TO RUSSIA PER SITC SECTIONS AND PER PERIODS – POLAND



5.1.6 Finland

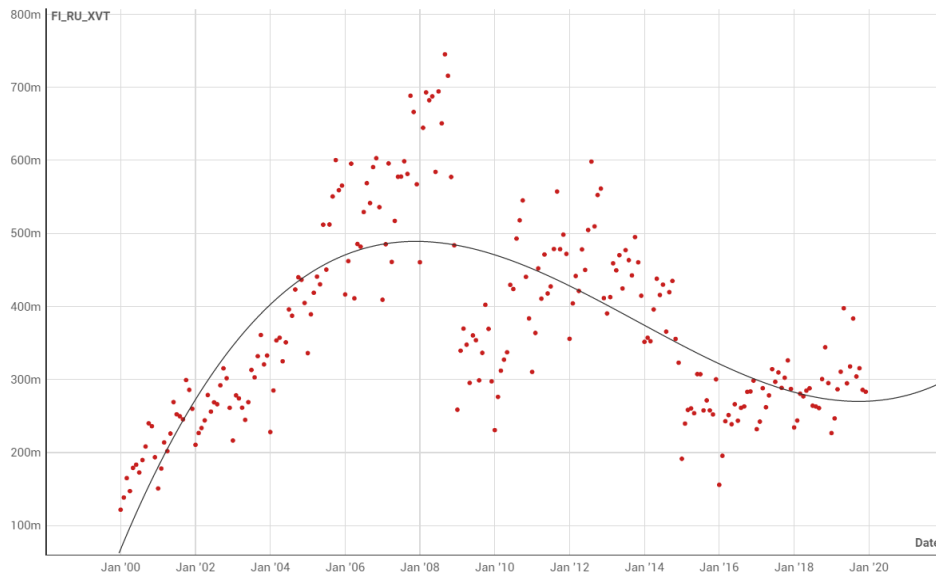
MAP I12
EUROPE MAP – FINLAND AND RUSSIA



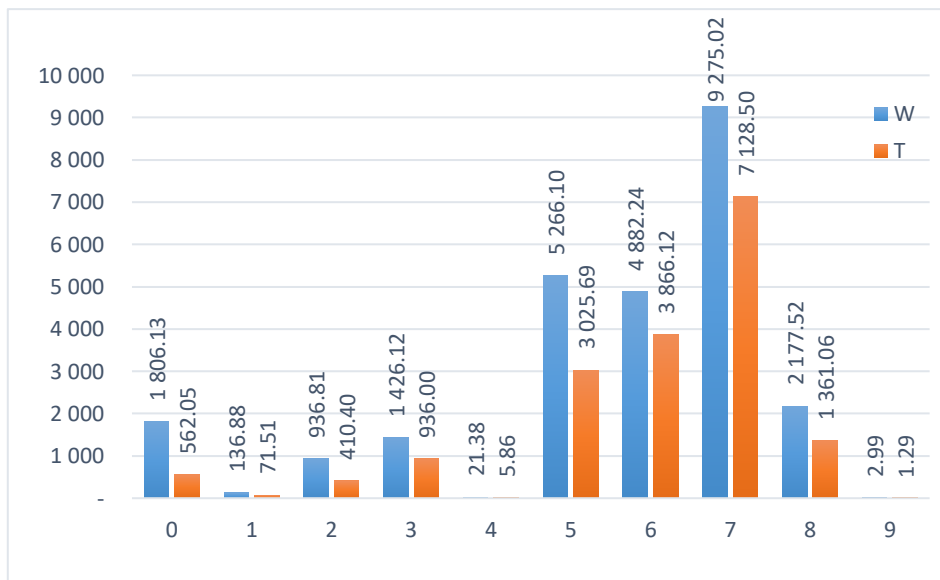
Finland takes the thirteenth place of European Union ranking by GDP. Its share in the EU total exports to Russia was 4.87% during the witness period (4.10%tp). Its total exports to Russia decreased by -32.8% (-8.83b€) between period, which is the third biggest decrease (after France) among the ten greatest European

exporters to Russia. Additionally, imports decreased by 21.9% (-11.48b€) and led to a small trade balance appreciation (2.65b€). Exports of under-embargo goods decreased by -97.3%(-1.2b€), meaning that they were still exported (for a total value of 33 m€). Thus, the country takes the eighth place in the embargo violators ranking. Contrarily to Germany, Italy, France, and the Netherlands, its total exports to Russia decreased less during events related to the Ukrainian crisis than during the 2009 economic crisis. Moreover, the cubic trend line offers hope for a quick return to normal. This is a testament to the strength of trade ties binding Finland and Russia. The leading export section is also Machinery and Transport Equipment (9.27b€wp, 7.12b€tp); it decreases by -23.14% (-2.14b€) between periods. As for the United Kingdom and the Czech Republic, exports of Chemicals and Related Products decreased between periods (-42.54%, -2.24b€). Another consequent decrease is the one of Food and Live Animals (-68.88%, -1.24b€), which is mostly due to the embargo since under-embargo products –included in this section– decreased by -1.20b€ between periods. Exports to Russia accounted for 9.3% of Finland's total exports to the world during the witness period, and collapsed to 2.39% during the test period (under-embargo products reached 4.61%wp, 0.18%tp).

GRAPH I-17
TOTAL EXPORTS TO RUSSIA IN VALUE (€) – FINLAND

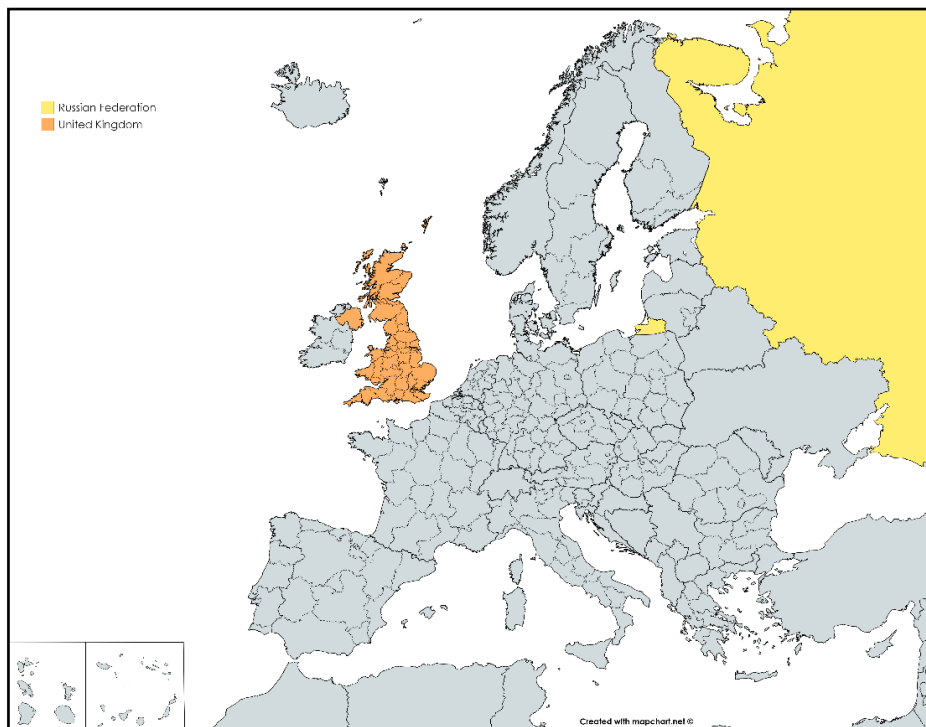


GRAPH I-18
EXPORTS (M€) TO RUSSIA PER SITC SECTIONS AND PER PERIODS – FINLAND



5.1.7 *The United Kingdom*

MAP I13
EUROPE MAP – THE UNITED KINGDOM AND RUSSIA

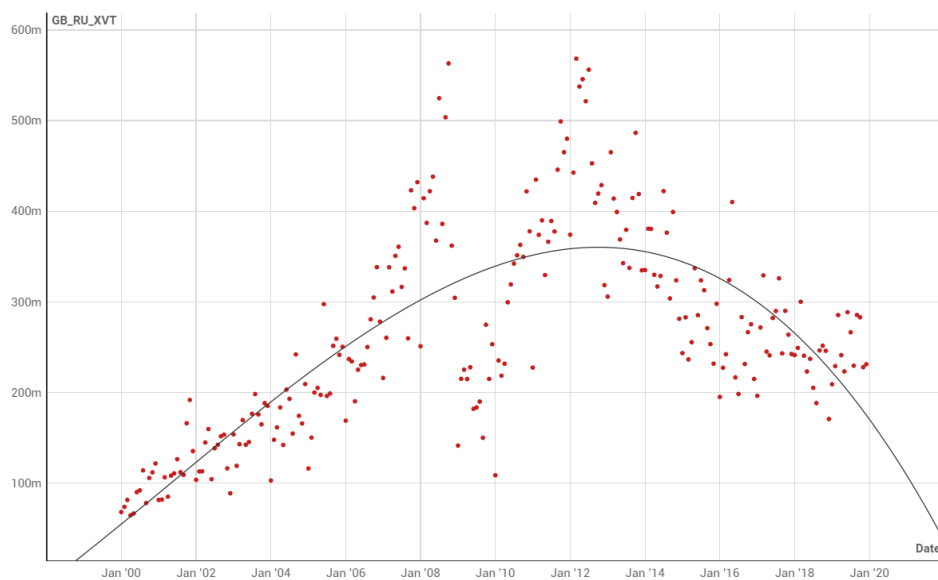


The United Kingdom is the second greatest European economy. Its exports to Russia accounted for 4.19% during the witness period (3.79%tp). The country lost -27.8% (-6.44b€) of its total exports to Russia between periods, while its total imports from Russia decreased by -3.8% (1.62b€). Consequently, its trade balance deteriorated by -4.81b€ between periods (-19.16b€wp, -23.98b€tp), recording the second greatest trade balance deterioration among our top 10. Its exports of under-embargo products decreased by -87.7% between periods (-227 m€). The United Kingdom didn't respect the embargo, and goods for a total value of 32 m€ were exported during the test period. This value puts the country at the ninth place of the embargo violators ranking. Similarly to the Netherlands, France, Italy and Germany, its total exports to Russia decreased as much (if not more) during the Ukrainian crisis than during the 2009 economic crisis. Moreover, the cubic trend line indicates that a return to normal is highly unlikely to happen anytime soon. As others⁷⁸, its leading exports section is Machinery and Transport Equipment

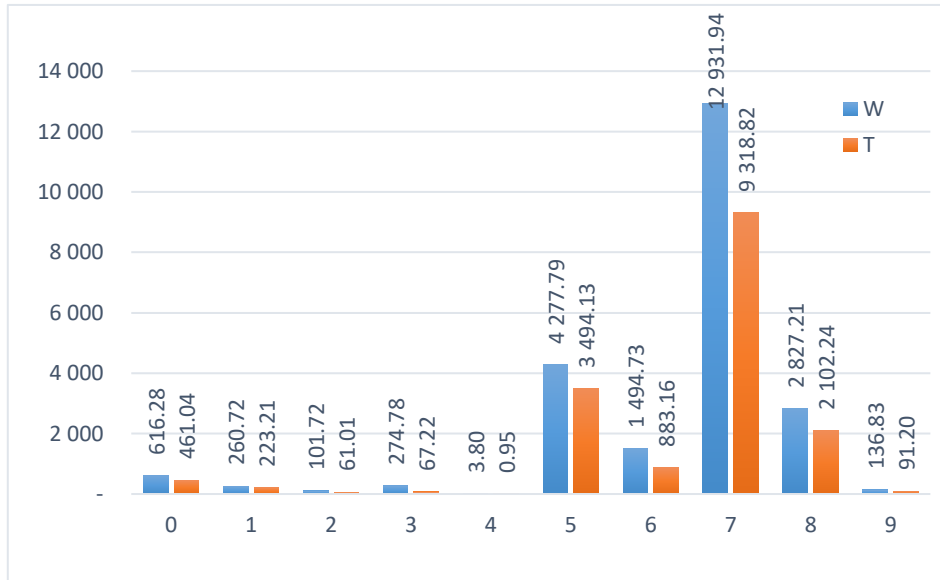
⁷⁸ Belgium is the only country of our top 10 for which the leading export section is not Machinery and Transport Equipment (but Chemicals and Related Products).

(12.93b€wp, 9.31b€tp); it decreased by -27.94% (-3.61b€) between periods. Chemicals and Related Products decreased by -18.32% (-783 m€). The United Kingdom didn't have a great dependence on trade with Russia (exports to Russia accounted for 1.24%wp, 0.76%tp) and exports of under-embargo goods accounted for only 1.12% during the witness period (0.19%tp). In fact, among our top 10, the UK is the least dependent to trade with Russia (see Annexes, [Table I-18](#)).

GRAPH I-19
TOTAL EXPORTS TO RUSSIA IN VALUE (€) – THE UNITED KINGDOM



GRAPH I-20
EXPORTS (M€) TO RUSSIA PER SITC SECTIONS AND PER PERIODS – THE UNITED KINGDOM



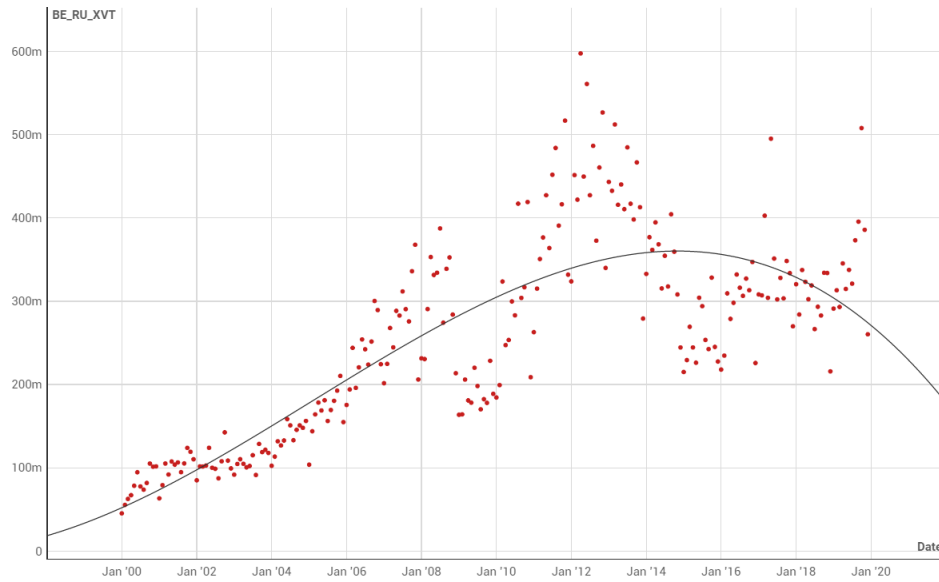
5.1.8 Belgium

MAP I14
EUROPE MAP – BELGIUM AND RUSSIA

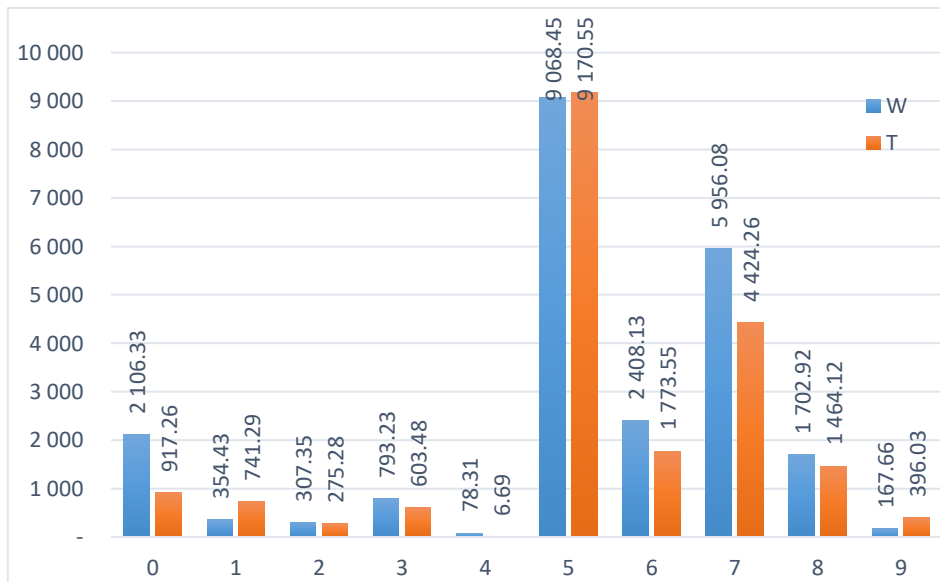


Belgium is the ninth economy of the EU and contributed to EU28 total exports to Russia for 4.17% during the witness period (4.47%tp). Its total exports to Russia decreased by -14.5% (-3.33b€) between periods, and its total imports from Russia increased by 5.5% (2.41b€, being the only country of our top 10 for which imports increased). Thus, Belgium's trade balance deteriorated by -5.74b€ (-21.05wp, -26.79tp), which is the biggest deterioration in value of our top 10. Besides, the decrease of under-embargo goods reached -87.3%(-971 m€). Hence, with a total value of 141 m€ of under-embargo goods exported during the test period, Belgium takes the fourth place in the embargo violators ranking. As Poland, its total exports to Russia decreased much more during the Ukrainian crisis than during the 2009 economic crisis. The cubic trend line is collapsing after 2014, quashing all hopes of a return to normal. The trade structure of the country's exports to Russia didn't change drastically between periods. Contrarily to other countries of our top 10, the leading export section of Belgium is Chemicals and Related Products (9.06wp, 9.17tp). It increased by 1.13% (102 m€) between periods. Moreover, exports of Commodities and Transactions marked a leap forward between periods (167m€wp, 396m€tp). Machinery and Transport Equipment is the second leading export section (5.95b€wp, 4.42b€tp); it decreased by -25.72% (-1.53b€). Finally, the shares of exports to Russia in total exports to the world are not high (1.3%wp, 1.2%tp), which means that the country's exposure to Russia is quite low (4.83%wp and 0.71%tp for the share of under-embargo goods in Belgium's exports to Russia).

GRAPH I-21
TOTAL EXPORTS TO RUSSIA IN VALUE (€) – BELGIUM

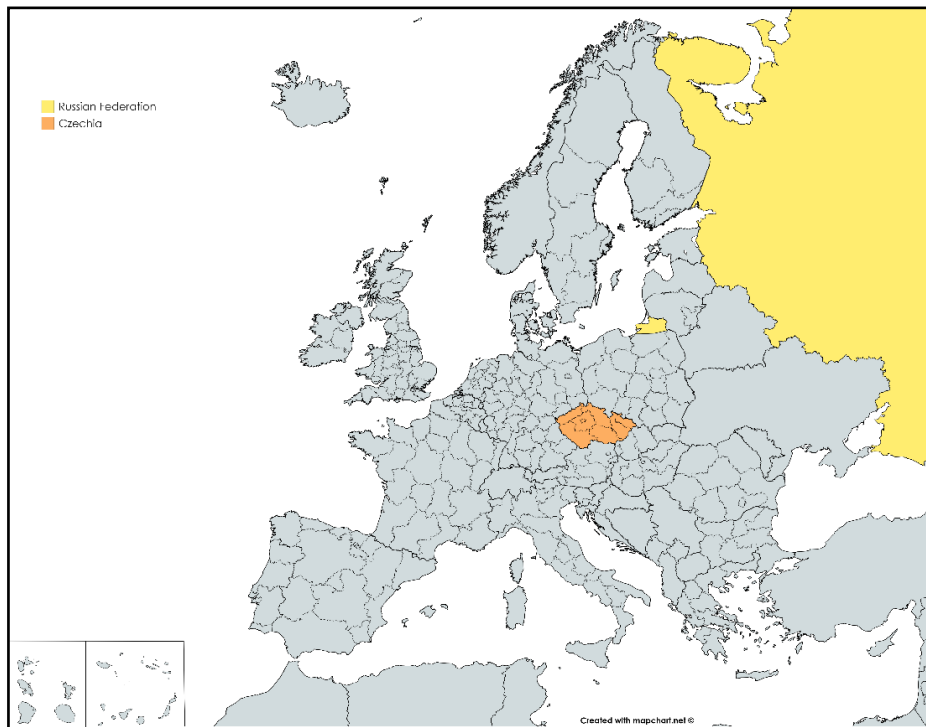


GRAPH I-22
EXPORTS (M€) TO RUSSIA PER SITC SECTIONS AND PER PERIODS – BELGIUM



5.1.9 The Czech Republic

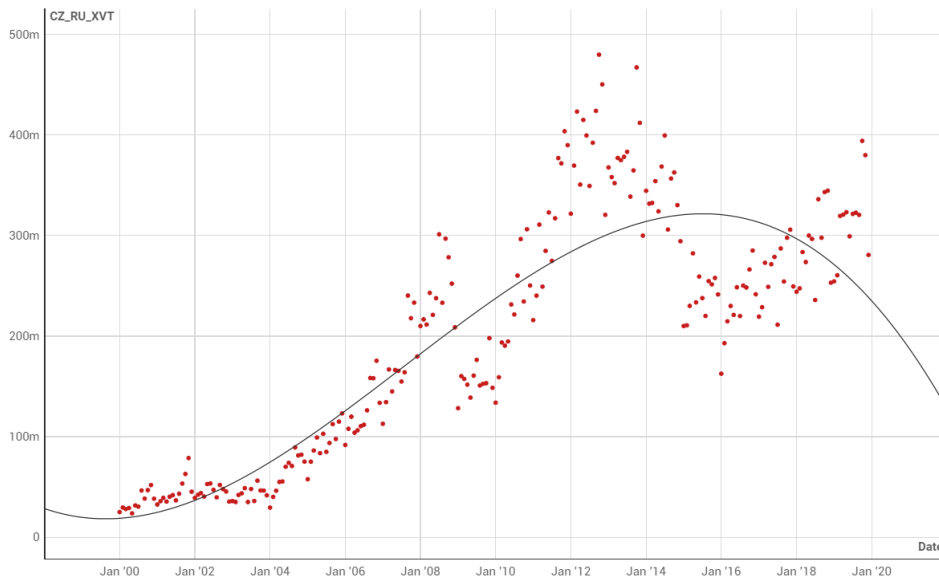
MAP I15
EUROPE MAP – THE CZECH REPUBLIC AND RUSSIA



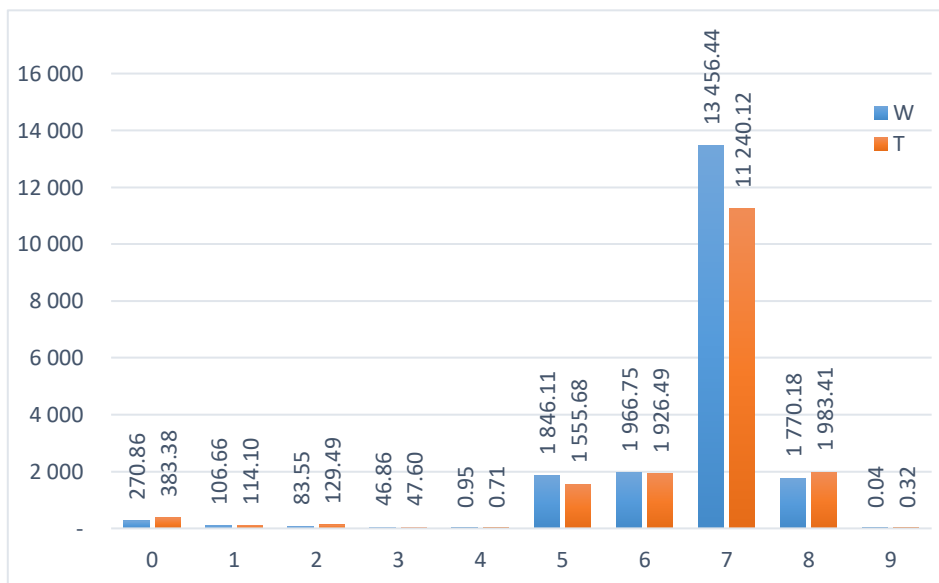
As the fourteenth EU economy, the Czech Republic accounts for 3.55% in EU28 total exports to Russia before the embargo (3.94%tp). Its total exports to Russia decreased by -11.4% (-2.24b€) between periods, while total imports decreased by -43.4%. The Czech Republic's trade balance is the only one that became positive between periods (-6.97b€wp, 2.34b€tp), increasing by 9.31b€. In parallel, under-embargo exports decreased by -89.2% (-30 m€). Without fail, forbidden goods have been exported during the test period, for a total value of 4 m€. This small amount puts the country at the fifteenth place in the ranking of embargo violators countries. As for Belgium, the Czech Republic's total exports to Russia decreased more during the Ukrainian crisis than during the 2009 economic crisis. The cubic trend line seems to indicate a historical breakdown, and it is hard to know for sure whether a return to normal will occur or not. The trade structure didn't change much. If Machinery and Transport Equipment decreases by -16.47% (-2.21b€), it is still the leading section (13.45b€wp, 11.24b€tp). Besides, Chemicals and Related Products (1.84b€wp, 1.55b€tp), Manufactured Goods (1.96b€wp, 1.92b€tp) and Miscellaneous Manufactured Articles (1.77b€wp, 1.98b€tp) have an almost similar

weight. Half trade sections increased by more than 4.28% between periods. Finally, exports to Russia represent 3.25% of the country’s total exports and fell to 0.87% during the test period; the shares of under-embargo goods in total exports to Russia are ridiculously low (0.17%wp, 0.02%tp).

GRAPH I-23
TOTAL EXPORTS TO RUSSIA IN VALUE (€) – THE CZECH REPUBLIC

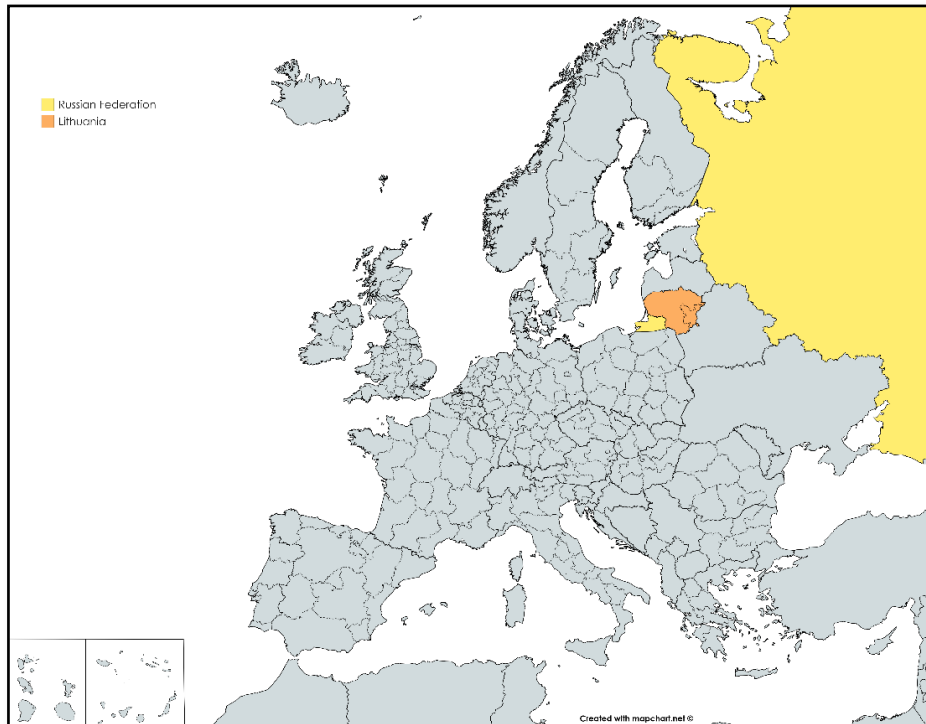


GRAPH I-24
EXPORTS (M€) TO RUSSIA PER SITC SECTIONS AND PER PERIODS – THE CZECH REPUBLIC



5.1.10 Lithuania

MAP I16
EUROPE MAP – LITHUANIA AND RUSSIA

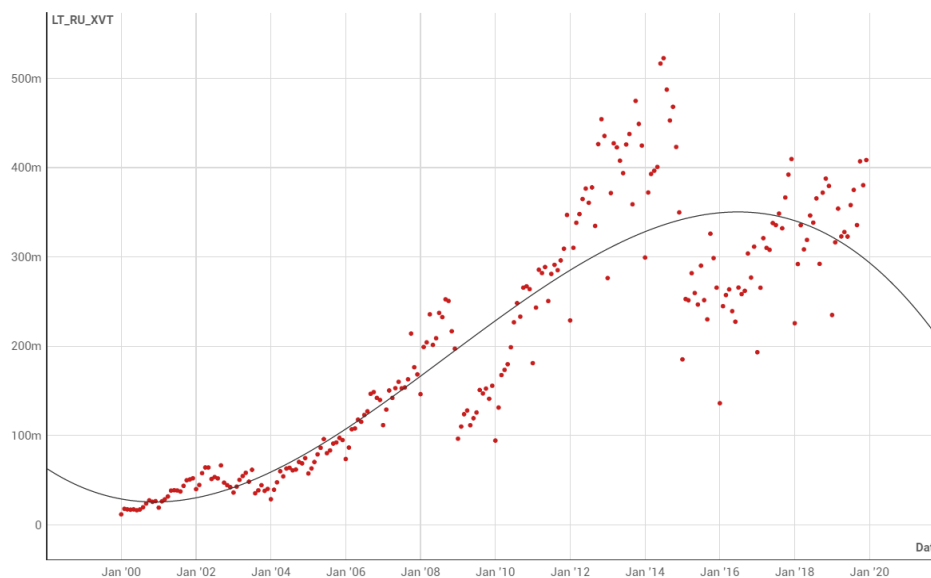


Lithuania is one of the smallest EU economies (twenty-fourth) and represents 3.53% of the EU total exports to Russia before the embargo (4.51%tp). Between periods, its total exports to Russia increased by 2.0% (398 m€) –this is the only increase of our top 10. Since total imports from Russia decreased (-36.0%) while exports increased, the country's trade balance with Russia appreciated by 12.81b€, reaching the value of -2.18b€. At the same time, with a fall of -3.42b€ (-91.2%) in exports of under-embargo goods to Russia, Lithuania endures the greatest loss among our top 10. As others, forbidden goods were still exported to Russia during the embargo (for a total value of 329 m€). Thus, Lithuania takes the second place in the embargo violators ranking. As Belgium or the Czech Republic, the country's total exports to Russia decreased more during the Ukrainian crisis than during the 2009 economic crisis.

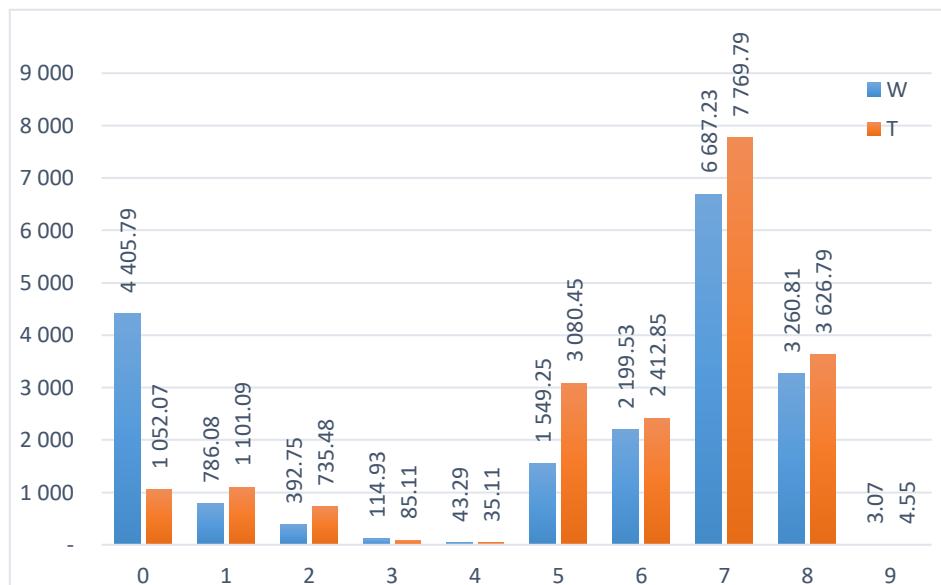
Additionally, the cubic trend line reveals a clear historical rupture (in 2014). Consequent changes appear in Lithuania's trade structure. The leading export section increased by 16.19% (1.08b€) and remains Machinery and Transport

Equipment (6.68b€wp, 7.76b€tp). Food and Live Animals (4.40b€wp, 1.05b€tp) lost its second place after decreasing by -76.12% (-3.35b€). Miscellaneous Manufactured Articles (3.26b€wp, 3.62b€tp) takes the second place with a 11.22% (365 m€) increase. Finally, as for the Netherlands, Italy and Poland, Chemicals and Related Products (1.54b€wp, 3.08b€tp) increases by +98.84% (1.53b€), which is the greatest increase in percentage of our top 10. However, the share of exports to Russia in its total exports to the world is the most stunning country's data. Indeed, 18.14% of Lithuania's total exports to the world headed towards Russia before the embargo, revealing a strong dependency on Russia (almost one fifth of its exports being related to Russia). Yet, this value falls down to 9.1% during the test period, decreasing by -9.05 pp. This is the greatest collapse among our top 10, right before Finland (-6.91 pp). Moreover, it also seems clear that Lithuania was the most exposed country (top 10) to the implementation of the Russian embargo, since under-embargo products account for 19.23% of its total exports to Russia during the witness period (fell to 1.65% during the test period).

GRAPH I-25
TOTAL EXPORTS TO RUSSIA IN VALUE (€) – LITHUANIA



GRAPH I-26
EXPORTS (M€) TO RUSSIA PER SITC SECTIONS AND PER PERIODS – LITHUANIA



5.1.11 Conclusion

A general overview is useful to conclude this section. Hence, it is clear that there are similarities between our top 10 regarding changes in trade structure between periods (among SITC sections). Thus, half countries examined register a decrease of more than -61.2% (-22 m€) in their exports of Animal and Vegetable Oils, Fats and Waxes. Similarly, Food and Live Animals decrease by more than -47.1% (-1.21b€) for half countries studied. On average, Chemicals and Related Products increased by 9.9% (189 m€). As well as that, countries of our top 10 –except the Czech Republic– have a negative trade balance in both periods. Moreover, there isn't a single country that entirely stopped exporting under-embargo goods among our top 10. The total value of exports of under-embargo products during the test period being 1.18b€, it means that the ten greatest European exporter to Russia account for 73.75%⁷⁹ of the EU's total. At the same time, there are real differences among countries regarding both their dependency in trade with Russia (see Annexes, [Table I-18](#)) and their exposure to the Russian embargo (see Annexes, [Table I-19](#)). Indeed, while 98.76% of the United Kingdom's exports were to the rest of the world, almost one fifth of Lithuania's exports were heading toward Russia. Similarly, the weight of under-embargo products in the trade with Russia is not

⁷⁹ The total value of exports of under-embargo goods for the EU is 1.60b€, during the test period.

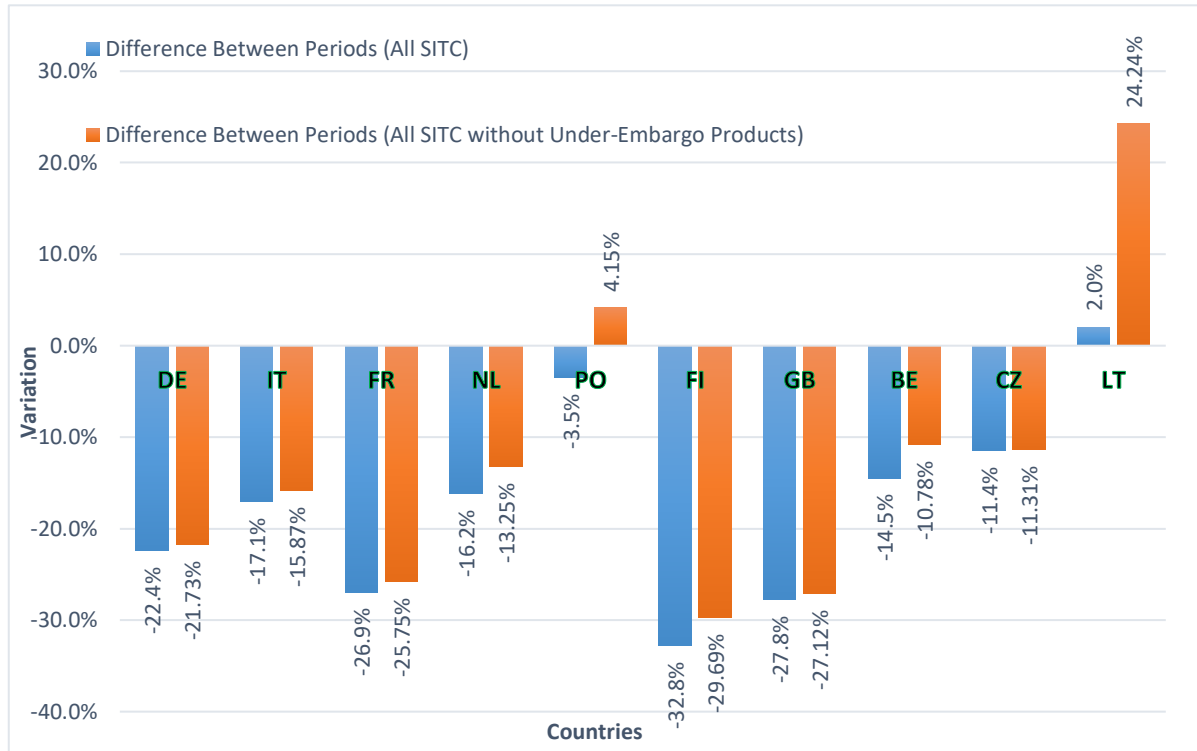
the same between countries. Accumulating tares, 18.14% of Lithuania's exports to Russia were targeted by the Russian embargo, while this share is only 0.99% for Germany. It is clear that some countries had a greater ability to take cover than others. Naturally, there are also inequalities in losses. Thus, while the embargo costed 2.50b€ to Poland (3.42b€ to Lithuania), it barely reaches 227 m€ euros for the United Kingdom, and only 30 m€ for the Czech Republic.

In this section, it was also shown that, unexpectedly, the total exports to Russia from many countries decreased after the beginning of the Ukrainian crisis (-32.8% for Finland, -27.8% for the United Kingdom, -26.9% for France, -22.4% for Germany, *et cetera*.) This is unexpected since most products exported to Russia from the EU aren't targeted either by the Russian embargo, nor by European sanctions. Indeed, the share of exports of under-embargo goods in total exports to Russia of the EU is lower than 1.36%wp for half countries (3.15%wp for the top 10). It means that the vast majority of goods exported to Russia from the European Union were not targeted by the Russian embargo. Knowing that, one can clearly wonder why these exports decreased that much between periods (-20.13% or -111.22b€ for all EU28 countries; -19.16% or -84.15b€ for our top 10). In addition, most countries haven't experienced such a decrease in their exports to Russia since the 2009 economic crisis. It seems essential to mention that if the EU total exports to Russia decreased by -111.22b€ between periods, Russia's total exports to the EU decreased by -219.16b€. It means that the "exports cost" for Russia is almost twice bigger than for the European Union between periods (-107.94b€).

Thus and as the European Union didn't establish any embargo to Russia, it might be possible that what affected the European exports to Russia has been affecting Russian exports to the EU even more significantly. These decreases might be the result of the economic war climate, actors being less likely to keep exporting to Russia because of the overall media coverage regarding the Ukrainian crisis. It is also possible that economic sanctions led to indirect effects, or that economic actors decided to apply the precautionary principle to avoid any financial sanctions. From another angle and as explained earlier, it is also possible that Russian demand regarding European products decreased because of a political integration

mechanism (or because of the Rouble depreciation). Reversely, a similar logic can be held regarding the collapse of Russian exports to the EU.

GRAPH I-27
DIFFERENCE IN DIFFERENCES (WITH OR WITHOUT UNDER-EMBARGO PRODUCTS)



It is also important to put forward that when examining total exports to Russia of our top 10 reduced by the value of under-embargo products –leaving us with products that were not targeted by the embargo, decreases are lower and increases are greater (see Graph I-27). For example, the removal of under-embargo products from total exports of Lithuania to Russia leads to an increase between periods of 24.24% instead of 2%. Moreover, Poland sees its exports to Russia increase by 4.15% instead of a -3.5% decrease. It means that exports of under-embargo goods either decelerate exports increases or accelerate exports decreases. Nevertheless, this phenomenon isn't so consequent, as the average deviation between differences –the difference between values of blue bars and orange bars in Graph I-27– reaches -4.34 pp only.

5.2 Gateway Countries

As described in previous sections, exports of under-embargo products from the EU to Russia almost stopped. They decreased by -90.7% (-15.63b€) between periods. These significant losses have certainly created incentives for the use of third-party countries in order to circumvent the embargo, see [Bonetti \(1998\)](#), [Caruso \(2003\)](#), *etc.* Thus, if one player wishes to do so, his best option would be to use a country that has a common border with both the EU and Russia. Such countries will be called “*gateway countries*”. They are an easy way to keep exporting –indirectly– to Russia, and to “legally” overthrow the embargo –through a re-export process. The logic is simple, if one wants to keep selling under-embargo goods, a good option would be to export them to a country that is not targeted by the embargo.

“Companies declare in our systems according to very precise rules on SAD (Single Administrative Document) for the extra-community and DEB (Declaration of Exchange of Goods) for the intra-community. The legislation on these flows includes rules (in particular customs procedures, country of origin or destination, country of origin, Incoterms, etc.) that perfectly define the trajectory of a good. Each state sets up means of control on entry into or exit from its territory in compliance with the rules of international trade. Moreover, you are certainly aware that the competent services of the different states communicate with each other. ».

*S. GNALEKO, DNSCE's statistical pole (French Customs), Oct. 2018.
Interviewed by Morad BALI. Initial statements were made in French and had to be translated.*

If customs claim that products’ traceability is total, arguing that it is not possible –for example– to turn Moroccan Oranges into Belarussian Oranges, the reality is quite different. Indeed, during this thesis work, several testimonies from members of Saint Petersburg French business community were collected. They were asserting that it is easy to find someone who can change products’ certificate of authenticity. This is done in order to, for example, let one believe that the product was produced in Belarus and not in a country of the EU. It even seems that some companies entirely specialised in this illegal activity. However, these testimonies can’t be used in this thesis since people involved wish to remain anonymous.

MAP I17
EVENTUAL GATEWAY COUNTRIES AND THIRD-PARTY COUNTRIES



5.2.1 Database

In order to obtain this section's results, it has been necessary to create three databases (one for each gateway country). These databases merge all subsections of under-embargo products (130 subsections in total), in order to obtain subsections and sections. Indeed, it was not possible to directly download subsections and sections as the embargo doesn't target all products located in them. Thus, each of the three databases gather around 4350 variables and 556 800 values. The study period remains as in Section 4, with a witness period (2009m5 – 2014m8) and a test period (2014m9 – 2019m12).

TABLE I-20
USED DATABASES

<i>Detail</i>	<i>EU_BY_XVTss_m</i>	<i>EU_NO_XVTss_m</i>	<i>EU_UA_XVTss_m</i>
Flow	Export	Export	Export
Details	EU28 to BY	EU28 to NO	EU28 to UA
Product	Under-Embargo	Under-Embargo	Under-Embargo
From	2009m5	2009m5	2009m5
Until	2019m12	2019m12	2019m12
Frequency	Monthly	Monthly	Monthly
Indicator	Value €	Value €	Value €
Data Source	Eurostat - [DS-018995]	Eurostat - [DS-018995]	Eurostat - [DS-018995]
Extracted on**	09.05.20	09.05.20	09.05.20
Last Update***	20.04.20	20.04.20	20.04.20

**EU28 stands for each country of the EU (28 members) treated separately, not as a sum of the 28. Similar logic for T10 that regroups the ten greatest European exporters to Russia.*

***Extraction date from Eurostat website; ***Last update of the database (made by Eurostat)*

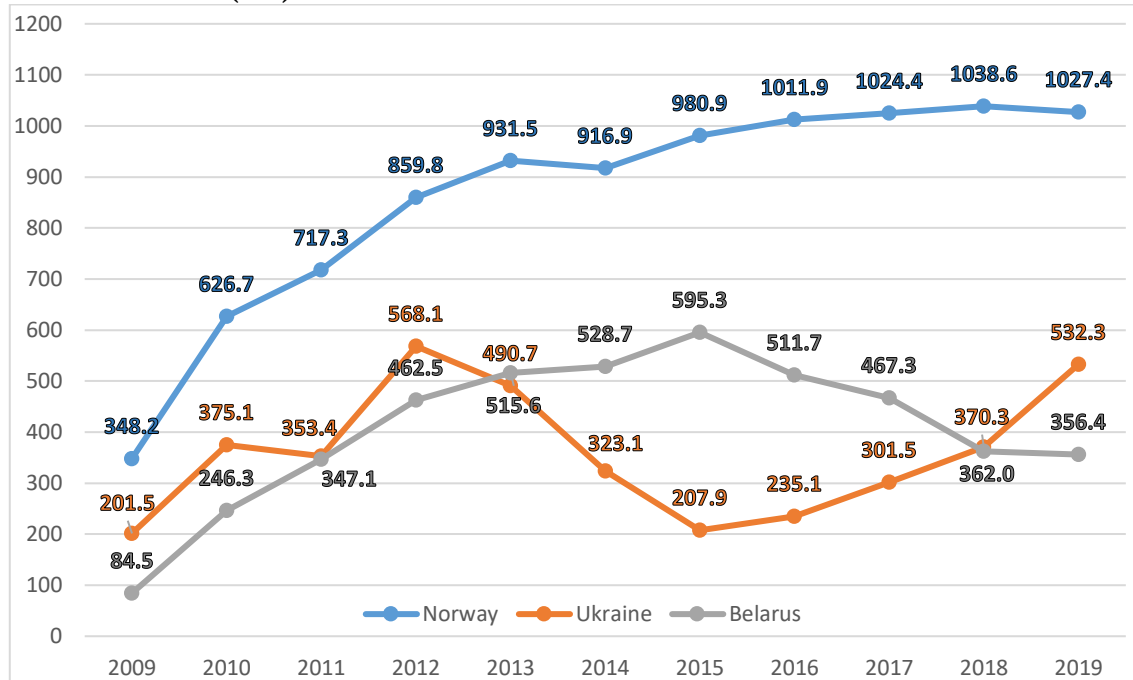
It would have been possible to examine subsubsections, but it has been decided to focus on subsections and sections. It is mostly because subsubsections contain too many missing value that are hard to handle, particularly since these flows are scattered and seem to follow a random walk.

5.2.2 Gateway Countries - Overview

In the frame of the Ukrainian crisis, there aren't many candidates to the status of gateway country. Geographically, it leads either to Norway that has a common border with Sweden, Finland and Russia, Belarus (common border with Latvia, Lithuania, Poland and Russia), and Ukraine (common border with Poland, Slovakia, Hungary, Romania and Russia). Thus, the trade of under-embargo goods between the EU and these three gateway countries will be studied. There is no confidence that Norway could be such a player, since the country fully committed to European sanctions, see [Hellquist \(2016\)](#). Moreover, the common border with Russia isn't quite well located, and doesn't seem propitious for ground trade –there is a clear geographical barrier. Yet, it is important to check if its obligations were fulfilled. Similarly, it would be rather strange that Ukraine –central actor of this economic conflict– acted as a gateway country. But it doesn't mean, though, that economic flows shall not be reviewed. Finally, Belarus seems to be a great

candidate as it has clearly been identified as a gateway between the EU and the Russian Federation, [Luptáková \(2019\)](#).

GRAPH I-28
EU28 EXPORTS (M€) OF UNDER-EMBARGO PRODUCTS TO GATEWAY COUNTRIES



From a general perspective, instinct prompts that a gateway country shall experience –right after the implementation of coercive measures– a consequent increase in its imports of under-sanction goods. The logic is simple, as products targeted by Russian sanctions are firstly exported to the gateway country, and then re-exported to Russia. Thus, a significant increase in the EU exports of such products shall be observed from the end of 2014 (it is assumed that there is a lag between the announcement of the embargo and the moment when economic actors adapt). As revealed in Graph I-28, there are not many variations in the EU exports of under-embargo goods to Norway. There is no significant increase, the trend remains and eventually stagnates. It seems logical and legitimates the geographical assumption raised earlier. Surprisingly, exports to Belarus did not increase, but decreased instead (from 595.3m€ in 2015 to 356.4m€ in 2019). It does not mean that some products were not exported to Belarus in order to then be re-exported. It means that it is not an overall trend, and that what has been observed –see [Luptáková \(2019\)](#)– might be true for some goods, but not for all. Finally, and in an even more unexpected way, exports to Ukraine increased by 156.07% from

2015 (207.9m€) to 2019 (532.3m€). During the test period, the total value of under-embargo exports from the EU to Ukraine reaches 1.75b€ (5.49b€ to Belarus, 5.38b€ to Norway).

TABLE I-21
SITC SUBSECTIONS

<i>SITC</i>	<i>Details</i>
011	Meat of Bovine Animals, Fresh, Chilled or Frozen
012	Other Meat and Edible Meat Offal, Fresh, Chilled or Frozen (Except Meat and Meat Offal Unfit or Unsuitable for Human Consumption)
016	Meat and Edible Meat Offal, Salted, In Brine, Dried or Smoked; Edible Flours and Meals of Meat or Meat Offal
017	Meat and Edible Meat Offal, Prepared or Preserved, N.E.S.
022	Milk and Cream and Milk Products Other than Butter or Cheese
023	Butter and Other Fats and Oils Derived from Milk
024	Cheese and Curd
034	Fish, Fresh (Live or Dead), Chilled or Frozen
035	Fish, Dried, Salted or In Brine; Smoked Fish (Whether or Not Cooked Before or During the Smoking Process); Flours, Meals and Pellets of Fish, Fit for Human Consumption
036	Crustaceans, Molluscs and Aquatic Invertebrates, Whether in Shell or Not, Fresh (Live or Dead), Chilled, Frozen, Dried, Salted or in Brine; Crustaceans, in Shell, Cooked by Steaming or Boiling in Water, Whether or Not Chilled, Frozen, Dried, Salted or in Brine; Flours, Meals and Pellets of Crustaceans or of Aquatic Invertebrates, Fit for Human Consumption
054	Vegetables, Fresh, Chilled, Frozen or Simply Preserved (Including Dried Leguminous Vegetables); Roots, Tubers and Other Edible Vegetable Products, N.E.S., Fresh or Dried
056	Vegetables, Roots and Tubers, Prepared or Preserved, N.E.S.
057	Fruit and Nuts (Not Including Oil Nuts), Fresh or Dried
058	Fruit, Preserved, and Fruit Preparations (Excluding Fruit Juices)
098	Edible Products and Preparations, N.E.S.
112	Alcoholic Beverages

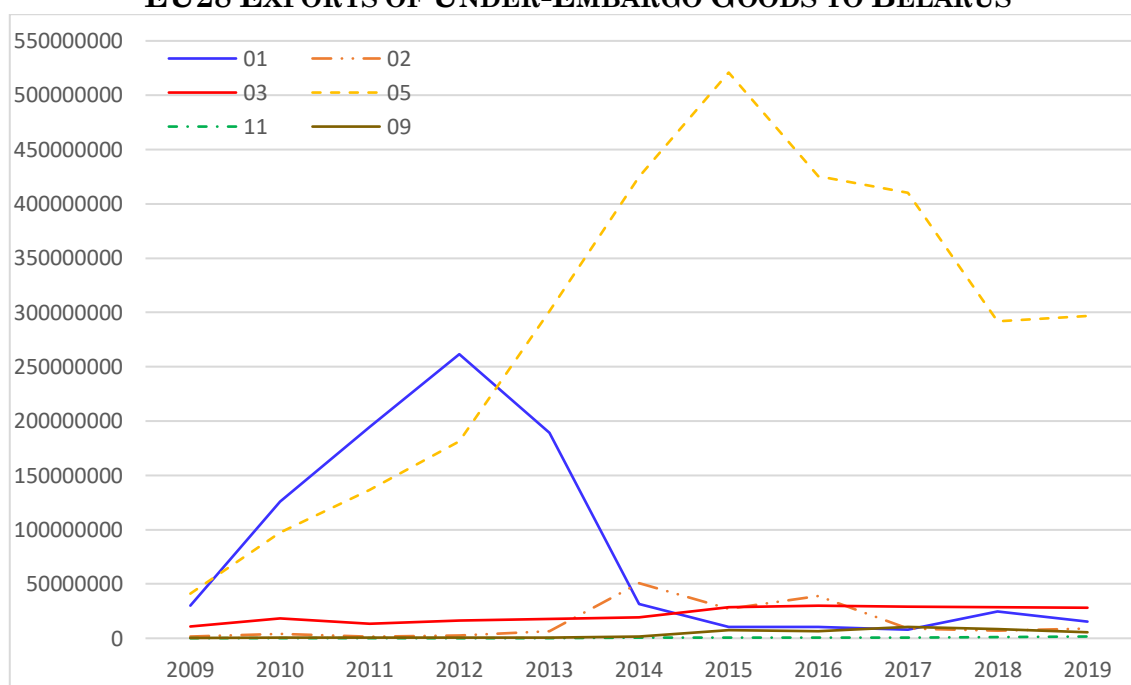
TABLE I-22
SITC SECTIONS

<i>SITC</i>	<i>Details</i>
01	Meat and Meat Preparations
02	Dairy Products and Birds' Eggs
03	Fish (Not Marine Mammals), Crustaceans, Molluscs and Aquatic Invertebrates, and Preparations Thereof
05	Vegetables and Fruit
09	Miscellaneous Edible Products and Preparations
11	Beverages

5.2.3 The Decrease of Under-Embargo Exports to Belarus

The first overview revealed that exports of under-embargo goods from the EU to Belarus decreased. Yet, details matter, and it is important to understand what is behind this decrease. Total exports of under-embargo products are composed of six sections and sixteen subsections. Naturally, they don't have the same weight in the total exported. For example, Section 05 "Vegetable and Fruits" is leading and accounts for 66.2% (in average) of the total exported between 2009 and 2019, while Section 11 "Alcoholic Beverages" is last and barely reaches 0.1%. See Table I-23 for further details. Thus, it means that the overall decrease of Section 05 between 2015 and 2019 (-43%) can absorb parallel increases; Section 01 increases by 44.5% between 2015 and 2019. For this reason, it seems more interesting to use an index base 100 = 2015 to observe variations that happen right after the embargo, see Graph I-30.

GRAPH I-29
EU28 EXPORTS OF UNDER-EMBARGO GOODS TO BELARUS



GRAPH I-30
EU28 EXPORTS OF UNDER-EMBARGO GOODS TO BELARUS, INDEX BASE 100 =

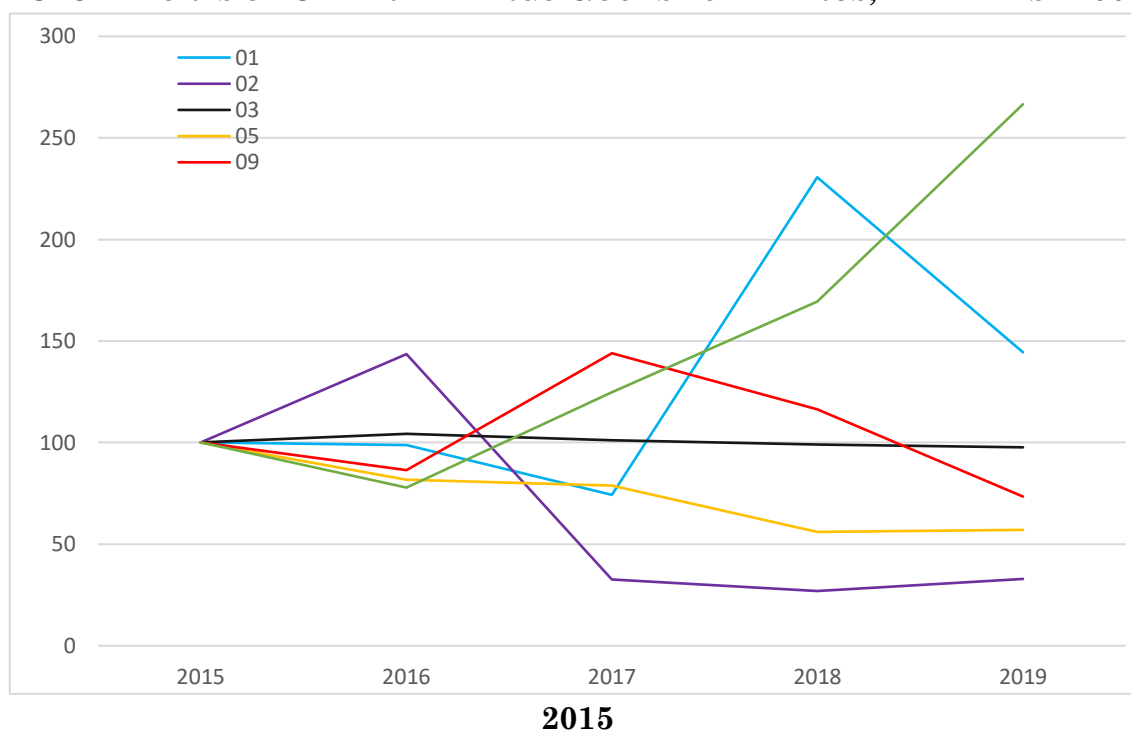


TABLE I-23
SHARE OF SECTIONS IN THE TOTAL EXPORTED
(EU28 EXPORTS OF UNDER-EMBARGO GOODS TO BELARUS)

<i>Year</i>	<i>01</i>	<i>02</i>	<i>03</i>	<i>05</i>	<i>09</i>	<i>11</i>
2009	35.9%	2.1%	12.9%	48.7%	0.4%	0.1%
2010	51.1%	1.6%	7.4%	39.5%	0.2%	0.1%
2011	56.1%	0.4%	3.9%	39.4%	0.1%	0.1%
2012	56.6%	0.6%	3.5%	39.2%	0.1%	0.0%
2013	36.7%	1.2%	3.4%	58.5%	0.2%	0.1%
2014	6.0%	9.6%	3.6%	80.3%	0.3%	0.1%
2015	1.8%	4.5%	4.8%	87.5%	1.2%	0.1%
2016	2.1%	7.6%	5.9%	83.2%	1.2%	0.1%
2017	1.7%	1.9%	6.2%	87.8%	2.2%	0.2%
2018	6.8%	2.0%	7.9%	80.6%	2.3%	0.3%
2019	4.3%	2.5%	7.9%	83.3%	1.5%	0.5%
Mean	23.5%	3.1%	6.1%	66.2%	0.9%	0.2%
Median	6.8%	2.0%	5.9%	80.3%	0.4%	0.1%

Thus, Section 02 “Dairy Products and Birds’ Eggs” and Section 03 “Fish, Crustaceans, *etc.*” both increase right after the establishment of the Russian embargo. Indeed, between 2015 and 2016, Section 02 increases by 43.6% (11.76 m€) and Section 03 by 4.3% (1.24 m€). Section 11 “Alcoholic Beverages” has a lag of one year, increasing by 242% (1.18 m€) between 2016 and 2019. It seems

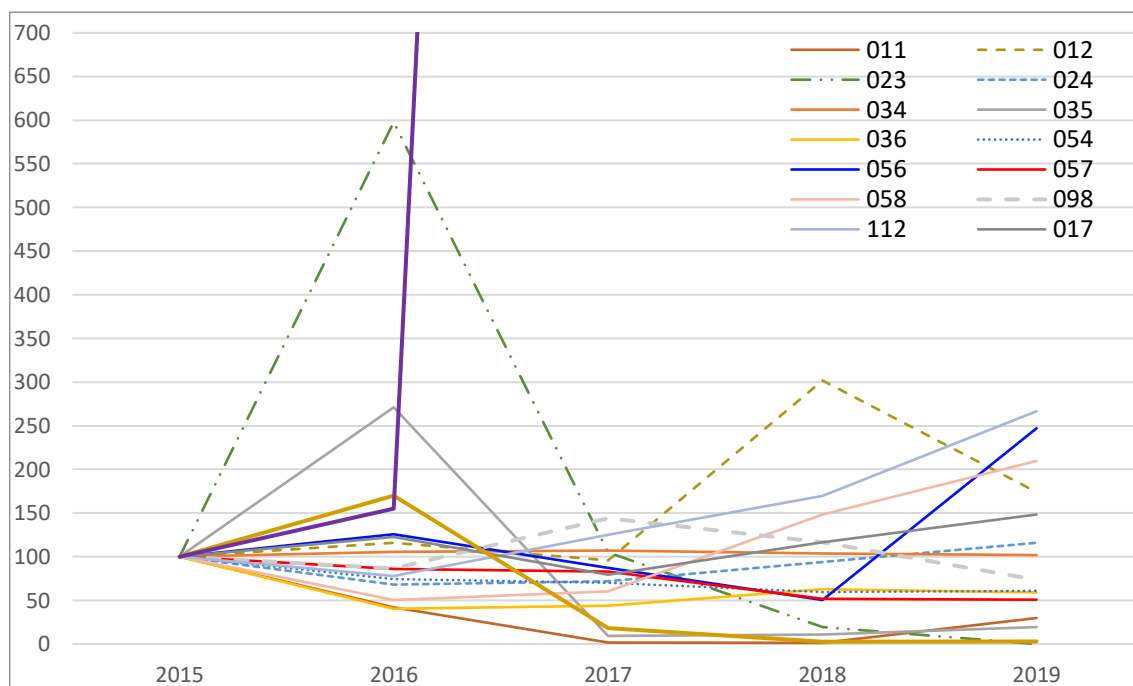
that even if some sections increased right after the establishment of the embargo, only Section 11 records a long-term and steady increase.

TABLE I-24
EU28 EXPORTS OF UNDER-EMBARGO GOODS TO BELARUS (M€)

<i>Year</i>	<i>01</i>	<i>02</i>	<i>03</i>	<i>05</i>	<i>09</i>	<i>11</i>
2009	30.302	1.732	10.888	41.140	0.302	0.098
2010	125.914	4.005	18.134	97.320	0.590	0.348
2011	194.643	1.502	13.566	136.710	0.455	0.214
2012	261.569	2.818	16.179	181.290	0.529	0.090
2013	188.991	6.381	17.666	301.403	0.818	0.370
2014	31.754	50.785	19.204	424.721	1.493	0.742
2015	10.714	27.005	28.795	520.876	7.294	0.625
2016	10.590	38.771	30.042	425.481	6.306	0.487
2017	7.960	8.816	29.106	410.103	10.504	0.781
2018	24.710	7.275	28.530	291.923	8.496	1.060
2019	15.483	8.907	28.130	296.871	5.358	1.667

Be as it is, it seems that the overall decrease in exports of under-embargo goods is real. Yet, it is essential to check what is happening one floor lower through the examination of subsection variations to ensure this conclusion. Thus, out of sixteen subsections, half have a positive variation between 2015 and 2016, while other half have a positive variation between 2015 and 2019. Nevertheless, decreasing subsections account for almost three quarters (72.6%) of the total (in value) exported throughout the whole period (2015-2019). As suspected, those that decrease are cancelling those that increase in parallel. For instance, between 2016 and 2019, exports of Section 016 “Meat and Edible Meat” exploded, increasing by 30 957% (476 429€). In addition, Section 012 “Other Meat” increased by 74.2% (5.98 m€), and Section 058 “Fruits” increased by 109.6% (11.8 m€). Finally, the sum of all increasing subsections between 2015 and 2019 was worth about 21.13 m€. Thus, even if the total value of subsections increasing is small, it is high enough to potentially explain exports for re-exportation motives. Nevertheless, causality can’t be taken for granted.

GRAPH I-31
EU28 EXPORTS OF UNDER-EMBARGO GOODS TO BELARUS (SUBSECTIONS)
INDEX BASE 100 = 2015



5.2.4 The Increase of Under-Embargo Exports to Ukraine

Ukraine is at the core of the Economic conflict between the EU and Russia. It all started with the Ukrainian crisis, the annexation of Crimea and the War in Donbas. Thus, from the Western perspective⁸⁰ –Ukrainian officials included⁸¹– Russia has invaded and still occupies the Ukrainian territory. As things currently stand, it seems quite strange –to put it mildly– to see under-embargo exports from the EU to Ukraine tremendously increase. Yet, they did increase by 156% (324.4m€) between 2015 and 2019. As before, it is useful to check what happened in detail, using SITC sections and subsections. Thus, there is an increase right after the embargo onset of Section 02 “Dairy Products”, Section 03 “Fish”, Section 09 “Miscellaneous Edible Products” and Section 11 “Alcoholic Beverages”; it breaks the decreasing trend of the past 2-3 years. The greatest increase is coming from Section 11 (see Graph I-33). However, this increase accounts for only 1.2% of the total exported to Ukraine between 2009 and 2019 (yearly average).

⁸⁰ <https://edition.cnn.com/2014/08/28/world/europe/ukraine-crisis/index.html>

⁸¹ <https://www.nytimes.com/2014/08/28/world/europe/ukraine-russia-novoazovsk-crimea.html>

In any event, most sections increase between 2015 and 2016. Section 03 “Fish” increases by 20.3 m€ (47.7%), which is the highest increase in value. Right after comes Section 02, increasing by 38.4% (9.8 m€). Sections 01 and 05 decrease respectively by -6.5% (-2.6 m€) and -3.6% (-3.4 m€) between 2015 and 2016. Finally, between 2015 and 2019, all sections are increasing. Section 02 “Dairy Products” records the highest score, increasing by 102.4 m€ (399.8%). Right after it comes Section 05 “Vegetables and Fruit” with a 73.02m€ (76.5%) increase. Thus, it means that if some sections didn’t increase right after the establishment of the embargo, there is still, however, a long-term and steady increase of under-embargo exports from the EU. This conclusion is backed by the examination of subsections. Indeed, the overall trend among subsections is similar: fourteen subsections (out of sixteen) have a positive variation between 2015 and 2016, and all subsections record a positive variation between 2015 and 2019. Subsection 024 “Cheese and Curd” is at the first place, increasing by 77.8 m€ (409.2%) between 2015 and 2019. Subsection 034 “Fish, Fresh (Live or Dead), Chilled or Frozen” takes the second place, increasing by 53.7 m€ (137.5%). More details in Table I-26.

GRAPH I-34
AS GRAPH I-33 WITHOUT SECTION 11

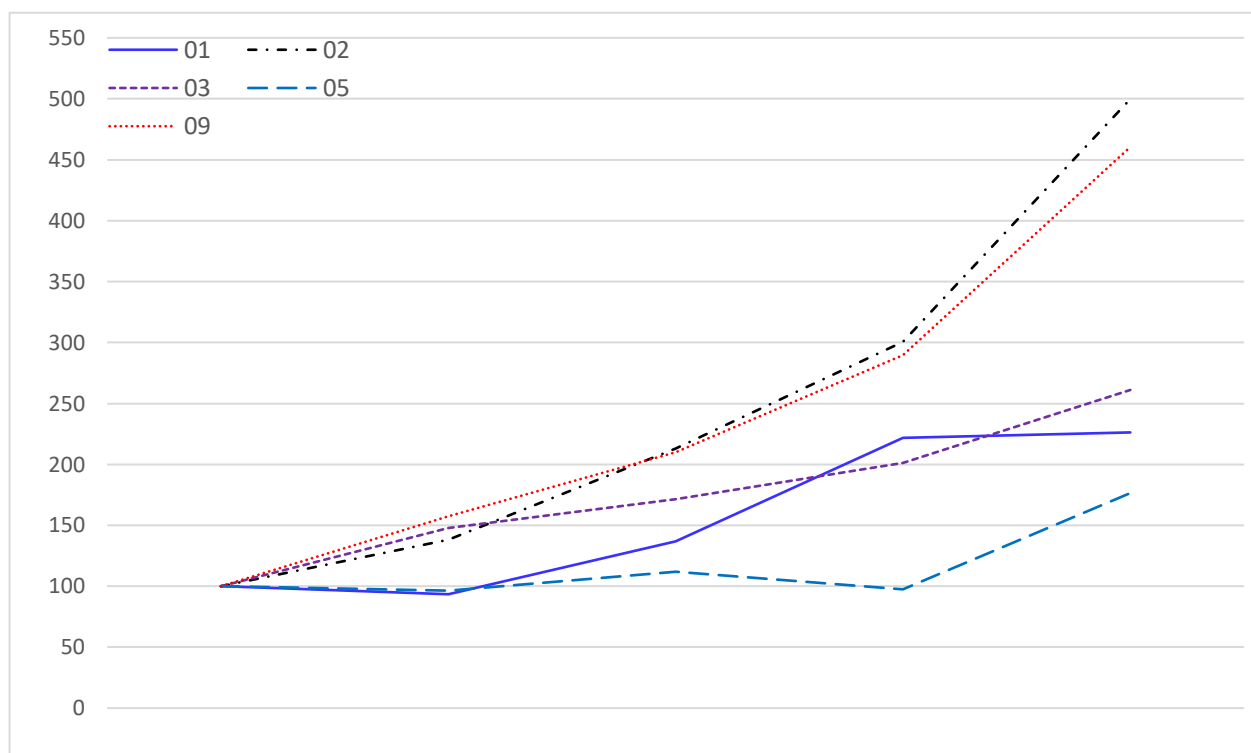
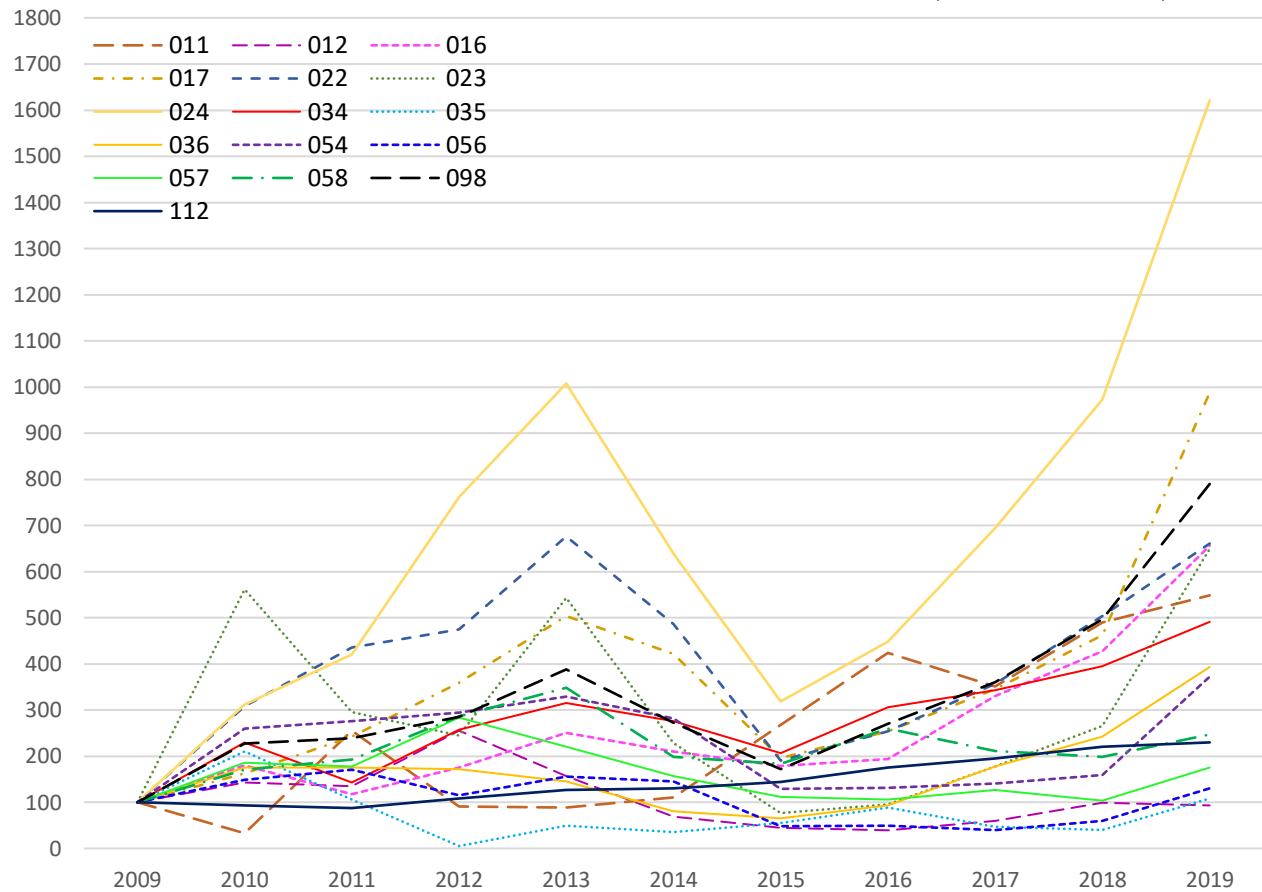


TABLE I-26
EU28 EXPORTS OF UNDER-EMBARGO GOODS TO UKRAINE (M€), SUBSECTIONS
VARIATIONS BETWEEN PERIODS

<i>Details</i>	<i>011</i>	<i>012</i>	<i>016</i>	<i>017</i>	<i>022</i>	<i>023</i>	<i>024</i>	<i>034</i>	<i>Period</i>
Value	1.01	-4.28	0.15	0.45	1.65	0.42	7.76	18.71	2015
Percentage	58.6%	-12.0%	8.2%	29.5%	33.3%	25.2%	40.8%	47.9%	to 2016
Value	1.82	38.36	5.01	6.20	12.23	12.45	77.80	53.77	2015
Percentage	105.2%	107.9%	266.1%	403.1%	246.9%	746.1%	409.2%	137.5%	to 2019
<i>Details</i>	<i>035</i>	<i>036</i>	<i>054</i>	<i>056</i>	<i>057</i>	<i>058</i>	<i>098</i>	<i>112</i>	<i>Period</i>
Value	0.47	1.21	0.24	0.00	-4.67	1.00	1.37	0.03	2015
Percentage	59.38%	42.37%	1.57%	1.92%	-6.01%	41.61%	57.41%	21.90%	to 2016
Value	0.76	14.32	28.74	0.18	43.27	0.83	8.61	0.09	2015
Percentage	95.62%	502.28%	188.43%	168.49%	55.69%	34.65%	360.47%	59.92%	to 2019

GRAPH I-35
EU28 EXPORTS OF UNDER-EMBARGO GOODS TO UKRAINE (SUB-SECTIONS)



5.2.5 Conclusion

Three possible gateway countries have been identified (Norway, Belarus and Ukraine) and the EU exports of under-embargo goods were examined. To no one's surprise, Norway isn't a credible candidate as there isn't any significant changes in its imports of under-embargo goods. It can be explained by the fact that the common border with Russia is facing a significant geographical barrier, which makes any type of ground trade quite costly. Hence, it wouldn't be rational to assume these costs when other trade routes are available. Belarus, described by Western press as the country where everything is passing through in order to access to the Russian market, presents in fact a much more mixed picture. Indeed, total exports of under-embargo goods from the EU to Belarus decreased right after the establishment of the Russian embargo. If Belarus was really used in order to re-export under-embargo products, there would be a significant break –starting

either in 2015 or 2016– in the trend of under-embargo exports from the EU to Belarus. Yet, it didn't happen. On the contrary, there is a clear historical fracture since the upward trend is broken in 2015, leaving room for a consequent decrease (-40.1% for a value of -238.8m€ between 2015 and 2019). Nonetheless, it was also shown that two subsections ran against the tide, increasing right after the implementation of Russian measures. Indeed, exports of “Butter and Other Fats and Oils Derived from Milk” increased by 83.3% (225 672€), while exports of “Fish, Dried, Salted or in Brine; Smoked Fish; Flours, Meals and Pellets of fish, Fit for Human Consumption” increased by 63.1% (879 237€). The last one can explain scandals about Belarussian seafood (Belarus is a landlocked country). It has also been revealed that Ukraine, surprisingly, saw its imports of under-embargo goods coming from the EU explode. Indeed, between 2015 and 2016, imports of such goods increased by 156.1% (304.4m€). Yet, it seems highly unlikely that Ukraine re-exported these goods directly to the Russian Federation (because of the geopolitical situation), and it seems more rational to believe that these goods might have been re-exported to Belarus instead (heading to Russia afterwards). Moreover, Belarus isn't the main gateway country, and Ukraine actually does better. Indeed, the total increase of exports of under-embargo goods from the EU to Ukraine is 317.4m€, while Belarus barely reaches 19.5 m€ (see Table I-27).

Finally, in order to balance previous findings, it is important to compare what was lost from the EU after the embargo's implementation to what was exported to Belarus and Ukraine. As a reminder, exports of under-embargo products from the EU to Russia decreased by -90.7% (-15.63b€) between periods. Thus, it is necessary to isolate subsections of European exports of under-embargo goods to gateway countries which: (i) started to increase in 2015 or 2016 (it is recognised that a lag is possible); (ii) record an increase from 2015 to 2019. By doing so, only trade flows suspected to be done for re-exportation motives are examined. Regarding Belarus, there are seven subsections that respect conditions (i) and (ii): 012, 016, 017, 024, 056, 058, and 122. Regarding Ukraine, all subsections respect the two conditions. The total value of the EU exports to Belarus and Ukraine for these subsections from 2014m9 to 2019m12 is 1.93b€. Yet, it doesn't seem logical to take into account this data. It seems more logical to focus on subsections' increases between 2015

and 2019, as these increases might be exports for re-exportation motives. Thus, by doing so, the value obtained is equal to 323.9m€ (214.2 + 109.7), see Table I-27. Consequently, if one considers that exports of under-embargo goods to Belarus and Ukraine –respecting the two conditions mentioned earlier– have been exported for re-exportation motives, the important result is that they barely cover 2.07%⁸² of the overall decrease in the EU exports of under-embargo goods to Russia. It means that even if causality could be demonstrated –unlike what has been done here– the use of gateway countries in order to overthrow the embargo remains minor.

TABLE I-27
EU28 EXPORTS OF UNDER-EMBARGO GOODS TO BELARUS AND UKRAINE
INCREASING SUBSECTIONS (M€)

<i>Subsection</i>	<i>011</i>	<i>012</i>	<i>016</i>	<i>017</i>	<i>022</i>	<i>023</i>	<i>024</i>	<i>034</i>	<i>Total</i>
Belarus	0.0	6.0	0.5	0.1	0.0	0.0	0.0	0.0	6.5
Ukraine	1.8	38.4	5.0	6.2	12.2	12.4	77.8	53.8	207.6
Total	1.8	44.3	5.5	6.3	12.2	12.4	77.8	53.8	214.2

<i>Subsection</i>	<i>035</i>	<i>036</i>	<i>054</i>	<i>056</i>	<i>057</i>	<i>058</i>	<i>098</i>	<i>112</i>	<i>Total</i>
Belarus	0.0	0.0	0.0	0.0	0.0	11.9	0.0	1.0	12.9
Ukraine	0.8	14.3	28.7	0.2	43.3	0.8	8.6	0.1	96.8
Total	0.8	14.3	28.7	0.2	43.3	12.7	8.6	1.1	109.7

⁸² 323.9m€ divided by 15.63b€.

III

Sanction Index Modelling

Abstract

This chapter describes the construction of the economic sanction index that is used in Chapter III econometric models. The first part of this chapter treats the methodology and mathematical formalisation used to build the sanction index. The second part is an empirical study comparing the index created in this thesis to another index previously developed in [Kholodilin and Netsunajev \(2016; 2019\)](#). Results reveal that the new sanction index has a stronger explanatory power. In addition, it seems that it affects short-term Russian production variations sharper than its predecessor.

1. Introduction

International economic sanctions are a common tool used by governments in order to assert their diplomatic will. Who has never heard of sanctions against such-or-such country, in the context of this or that diplomatic crisis? At the time of writing, it is easy to find several examples of these coercive measures. Iran, since its nuclear program became public. Cuba, even if sanctions have been recently lightened. Venezuela, regarding the “*Government of Venezuela’s erosion of human rights guarantees, persecution of political opponents, curtailment of press freedoms, use of violence and human rights violations, [...]*” as stated in the Executive Order 13692⁸³. Russia, on the basis of events resulting from the Ukrainian Crisis. Yet, do they work? And even if they do, are they efficient? Are there externalities –positive or negative– induced by their implementation? These questions cannot find reliable answers without a strong quantitative analysis. The econometric tool is a must, in hopes of measuring sanctions’ effects.

A reasonable number of economists have been studying these punitive measures since the 70s. From [Doxey \(1980\)](#), to [Hufbauer et al. \(1990a, 1990b\)](#), [Pape \(1997\)](#), or [Drury \(1998\)](#) a significant amount of work has been done. Although authors regularly disagree⁸⁴ on terms and definitions, most of them agree on the fact that sanctions do not work. Moreover, these coercive measures often have unpredictable effects that are, paradoxically, in the very interest of targeted countries. However, econometric models used in the studying of sanctions aren’t numerous. Most of the time, economists use gravity models. This tool is interesting as it allows us to appreciate changes in trade due to sanctions. To do so, diplomatic measures are modelled through a dummy variable equal to 0 if there aren’t sanctions, and to 1 if sanctions are enacted. Then, historical data without sanctions are compared to data with sanctions. If this method reveals all changes that happened after the arrival of sanctions, it does not help to isolate variations that are only due to

⁸³ U.S. Department of The Treasury, March 8, 2015.

<https://www.treasury.gov/resource-center/sanctions/Programs/Documents/13692.pdf>

⁸⁴ George et al. (1971) have updated Doxey’s definition (1971), [Pape \(1997\)](#) have vehemently argued the findings of [Hufbauer et al. \(1990\)](#), et cetera.

sanctions. [Feenstra et al. \(2001\)](#), [Hufbauer et al. \(2003\)](#), [Caruso \(2003\)](#), or [Yang et al. \(2004\)](#) –to mention a few, have all used gravity models in their papers.

Notwithstanding the interest of gravity models, another kind of model seems to be more appropriate in the study of sanctions. Vector Autoregression models (SVAR, TAR, STAR, SETAR, and so on), provide a brand-new way of seeing things. They allow us to measure the variation of one variable due to its past value, or to the past value of another factor. In other words, we are now able to isolate the economic impact of sanctions from other causes (inflation, oil price, and so on). This being said, it is important to bear in mind that this kind of model requires a proper sanctions modelling. It means that one must, first of all, be able to transform these punitive diplomatic measures into algorithm. Secondly, it also means that results' robustness and reliability will mostly depend on sanctions algorithm. If it doesn't reflect the economic reality stemmed from these measures, the model will probably lead to biased results. Knowing that, we can easily understand that our best efforts must be put toward sanctions modelling. To our best knowledge, [Dreger et al. \(2015\)](#) were the first who used a Vector autoregression model to study sanctions. In their paper, they tried to find if the Russian rouble collapse was mainly due to sanctions or to the decline in oil prices. In order to answer this question, they ran a model in which these punitive measures were integrated. They succeeded in building a "Sanction Index" simulating the economic impact of diplomatic measures implemented during the Ukrainian Crisis. One year later, this index was updated by [Kholodilin and Netsunajev \(2016\)](#)⁸⁵. However, their index requires serious modifications in order to give a faithful and clear picture of reality. This paper is dedicated to the conception of a new sanction index. It will not only be more robust or reliable to simulate sanctions in the Ukrainian Crisis case, but it will also be a multipurpose index, with a general shape that can be adapted to any case study. To that end, the first part of this paper will be dedicated to the mathematical formalisation of our index. The second part will then use this formalisation in the context of the Ukrainian Crisis case, in order to demonstrate changes brought by our new index.

⁸⁵ The final version of their paper has been published in 2019, see Kholodilin and Netšunajev (2019).

2. Mathematical Formalisation

This part describes and compares the previous sanction index from [Dreger *et al.* \(2015\)](#) to our new sanction index. Our goal is to have a better understanding of their differences, in order to assess the advantages of one over the other.

2.1 Previous Composite Index

[Dreger *et al.* \(2015\)](#) have established a sanction index for the Ukrainian crisis case. This index has been expanded by Kholodilin and Netšunajev (2019). This composite index is the aggregation of dummy variables over time. The dummy can be equal to 1, 2 or 3, depending on the sanction type. Then, the dummy's value is weighted by the issuing country's share in the target's foreign trade, see Figure 1. This index is far from perfect, but it is the first to illustrate sanctions within the framework of vector autoregression models (to our best knowledge). However, although it simulates rather well the arrival of international punitive measures, its value either grows over incoming new sanctions or stagnates if nothing is happening. It never decreases over time. This implies that the economic impact of diplomatic measures –that is the economic pressure applied on their target– is sustainable and invariable.

A sanction applied in September 2014 will impose at least –if not more– the same pressure in September 2015, September 2016, *et cetera*. Obviously, one doesn't have to be a sanction expert to understand that this postulate does not reflect reality. In addition, this index does not treat sanctions independently from each other. A bonus or a penalty cannot be applied to one sanction without affecting another. *In fine*, it is also impossible to know which measure cost more to a country (e.g. what is the most effective between American and European sanction regimes?) For these reasons, it is essential to create a new index that is able to simulate effects of coercive measures more faithfully.

2.2 New Composite Index

The new index is also the aggregation of sanctions over time. Yet, it has been decided to handle sanctions independently from each other. Each sanction has its own identity, allowing us to specify its own parameters. This index is defined as:

$$S_{t,k} = \sum_i s_{t,k,i} \quad , \quad (1)$$

with s a sanction of identity i , imposed by a country k in period t . By doing so, if one sanction varies or, if the economic pressure inflicted by the sanction changes, other sanctions will not be affected. However, parameters defining a sanction identity are many, and authors had to focus on the more viable and workable ones.

2.2.1 Sanction Type

The first parameter that can be specified in order to define a sanction's identity is the sanction type. Is the coercive measure against an individual? A company? An entire economic sector? The idea behind this is that economic pressure applied by diplomatic measures depends on the sanction type. Indeed, a sanction targeting individuals will not have the same economic consequences as one that aims an economic sector. This being said, measuring the degree of economic pressure applied by this or that type of sanction on a case-by-case basis is a long and difficult task –if not impossible. Moreover, there is no guarantee that the outcomes of such research would drastically change models' results. This is why it has been decided to use a heuristic to simulate the economic pressure inflicted, depending on the sanction's type. Thus, the sanction type parameter can be written as:

$$\alpha_{t,k,i} \quad , \quad (2)$$

where $\alpha_{t,k,i}$ is a constant for which the value depends on the type of sanction, see Table II-1. Authors are perfectly aware that this manner is not optimal, and all values can be modified upon request, in order to fit other studies.

$$E = \{0,1,10,100,1000,3000\}$$

$$\{\alpha_{t,k,i} | E(\alpha_{t,k,i})\}$$

TABLE II-1
VALUES OF THE “SANCTION TYPE” PARAMETER

α Value	Description
0	Absence of sanctions
1	Sanction against an individual
10	Official announcement of sanctions
100	Sanction against a company
1,000	Sanction against an economic sector
3,000	Embargo

Note: Authors are well aware that these values are arbitrary. Yet, one must understand that it is a first proposal to allow us to expose the rest of our work to criticism. Meanwhile, it gives us a moment to make further simulations in order to find optimal values. The idea behind it is that since Alpha's values differ depending on each sanction case, researchers shall deduce these values on a case-by-case basis. That is, through a trial and error approach instead of arbitrary choices.

2.2.2 The Economic Leverage

The second parameter is the economic leverage, which describes the ability of the sanction sender to apply economic pressure on its target. To assess this ability, two main components are considered. Firstly, the trade intensity between the sanction sender and its target:

$$A_{t,k,j} = \frac{T_{t,k,j}}{T_{t,j}}, \quad (3)$$

with $T_{t,k,j}$ the total exports of j to k , and $T_{t,j}$ country j total foreign trade. Here it is assumed that exports are beneficial to the considered economy, while imports are a burden. For this reason, only exports are accounted in $A_{t,k,j}$. Yet, it is also possible in some specific cases to see imports as vital resources for the country, since it might not be possible to obtain these goods otherwise. If so, $T_{t,k,j}$ could be the total exports and imports of j to k .

Therefore, $A_{t,k,j}$ defines the fact that if the sanction sender (k) and the target (j) do not trade with each other, it is highly unlikely that any punitive economic measures will be effective and $A_{t,k,j} \rightarrow 0^+$. On the contrary, if players have a strong trade relationship and $A_{t,k,j} \rightarrow 1$, sanctions will have the wherewithal to exert economic pressure. Secondly, the weighting of foreign trade in the target's economy:

$$B_{t,j} = \frac{T_{t,j}}{Y_{t,j}}, \quad (4)$$

with $Y_{t,j}$ the GDP of country j . This component witnesses the fact that even if players do have a strong economic relationship (i.e. $A_{t,k,j} \rightarrow 1$), sanctions might remain poorly effective if the target's foreign trade accounts for a very small share of its economy ($B_{t,j} \rightarrow 0^+$). Oppositely, if the under-sanction country's economy highly depends on foreign trade ($B_{t,j} \rightarrow 1$), coercive measures have good prospects of success. After all, the economic leverage can be defined as:

$$\beta_{t,k,j,i} = A_{t,k,j} * B_{t,j} . \quad (5)$$

Thus, for the economic leverage to be fully effective ($\beta_{t,k,j,i} \rightarrow 1$), players must be in a strong trade relationship ($A_{t,k,j} \rightarrow 1$), and the target's economy must be highly dependent on foreign trade ($B_{t,j} \rightarrow 1$). Finally, the last important point to consider is that trade relationship integrated in equations (4) and (5) should focus on economic sectors under sanctions. Indeed, if players mostly trade goods that aren't targeted by sanctions, coercive measures shall not be able to apply such a great economic pressure.

2.2.3 Time Factor

The third and last parameter gathers unconsidered factors that have a negative effect on the economic pressure applied by punitive measures. It witnesses the effect of time on the economic pressure induced by a sanction. It has been highlighted and demonstrated in [Neuenkirch and Neumeier \(2015\)](#). Moreover, an entire paper was earlier dedicated to this, see "How Long Economic Sanctions Last" from [Bolks and Al-Sowayel \(2000\)](#). They examine 108 sanction cases and one of the conclusions that they reach is that:

"While the focus of this examination is not on sanction success, there is an underlying logic that links these two outcomes: shorter episodes are associated with more success while longer ones typify failure."

([Bolks and Al-Sowayel \(2000\)](#), p. 242).

Thus, it reflects the fact that a penalty issued in t will not have similar economic effects in $t + 1$ or in $t + 20$, for example. In other words, it is the required time for an economy to adjust to sanctions. This parameter is written as:

$$\chi_{k,i,u} = \left(1 - \frac{u_{k,i}}{U_{k,i}}\right)^{o_{k,i}}, \quad (6)$$

where , k and i remain as defined before, but with u representing an instant from a different timeline than t . Indeed, while t is defined depending on the series' timeline (expressed in months, quarters, and so on), u is expressed in periods ($u \in \mathbb{R}$) and depends on the sanction's issuing date. Meaning that u can perfectly evolve independently from t . U is the ending date of the considered sanction i . Finally, $o_{k,i}$ defines the slope of $\chi_{k,i,u}$. The lower $o_{k,i}$ is, the more horizontal the slope will be, and the less the time factor will negatively impact the sanction's ability to apply economic pressure. Reversely, the higher the value of $o_{k,i}$ is, the more vertical the slope will be. In other words, $o_{k,i}$ is allowing us to calibrate the time factor intensity and behaviour.

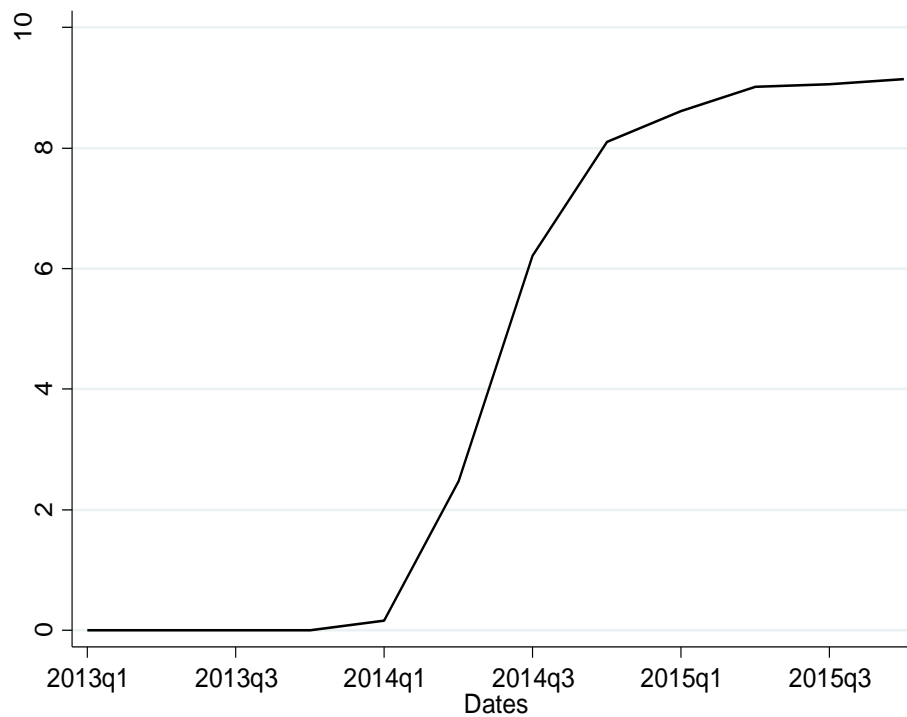
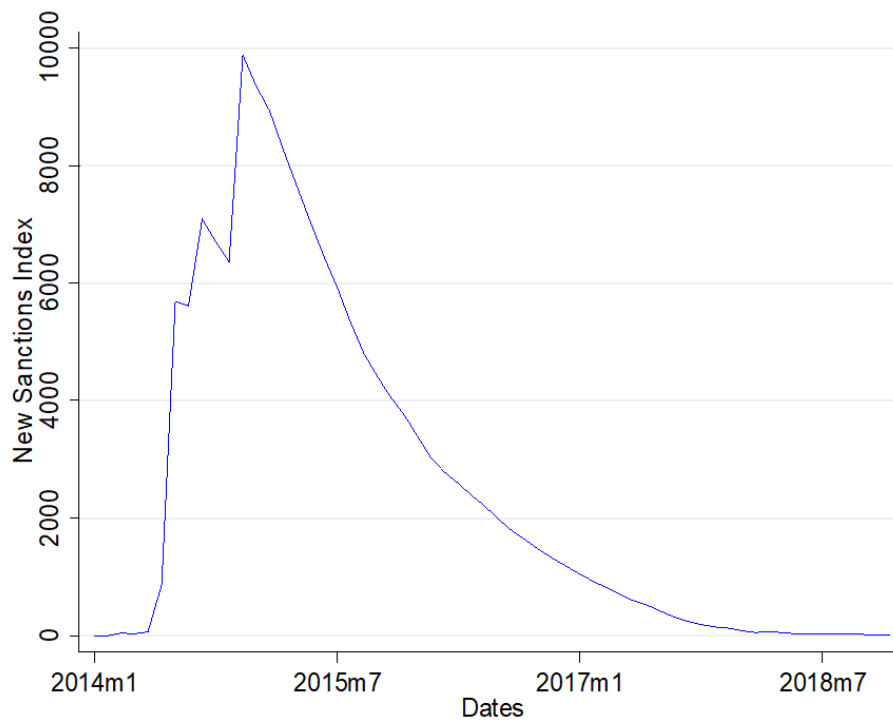
When the sanction has been implemented ($u = 0$), the economic pressure brought by the punitive measure is total and $\chi_{k,i,0} = 1$. On the contrary, when the sanction's ability to inflict economic pressure is completely void $\chi_{k,i,U} = 0$. Meaning that:

$$\{\chi_{k,i,u} \in \mathbb{R} \mid 0 \leq \chi_{k,i,u} \leq 1\}.$$

Naturally, $\chi_{k,i,u}$ and $o_{k,i}$ will be easier to calibrate in a past and ended sanction regime, than in a present case study –mostly because it will be possible to assess how fast sanctions have lost their efficiency over time. Reversely, if the sanction regime is not over at the time of studying, some arbitrary choices will need to be made. However, as each coercive measure is unique, this calibration will have to be done on a case-by-case basis, depending mostly on exogenous factors and results of statistical investigations. In the end, the new sanction index shall be equal to:

$$S_{t,k} = \sum_i s_{t,k,i} = \sum_i (\alpha_{t,k,i} * \beta_{t,k,j,i} * \chi_{k,i,u}) \quad (7)$$

GRAPH II-1
NEW SANCTION INDEX VS PREVIOUS SANCTION INDEX



Notes: The new sanction index is in blue colour, and the previous sanction index is in black colour. The new sanction index is the sum (as explained in equation 7) of all European sanctions against Russia from March 2014 to March 2018. It is displayed in monthly frequency to reveal further details. Parameters' specification is available on request. Data used for the New sanction index used in Chapter III (quarterly version) are in Annexes, [Table II-s](#), with quarterly values from 2014q1 to 2019q4. Data used for the previous sanction index are in [Dreger et al. \(2015\)](#).

3. Empirical Analysis

In this section, the main objective is to proceed to an empirical check of the new index, in comparison to the previous index of Kholodilin and Netšunajev (2019). In order to highlight differences between indexes, our main strategy is based on the use of SVAR models –mostly because they focus on effects of implemented idiosyncratic shocks through our endogenous variables across time. To be precise, results of orthogonalized impulse response functions (OIRFs) and variance decomposition of forecast errors (FEVD) will be studied to highlight differences between indexes. For consistency of comparison, four-country SVAR models based on the Ukrainian crisis case will be run, in order to assess sanctions impact on Russian GDP –represented in this paper by the Industrial Price Index as proxy⁸⁶. However, differences between sanction indexes will be studied in two distinct parts. Firstly, with two initial SVAR country models (A) and (B), regulated by two control variables, and secondly, through two extended SVAR country models (C) and (D), integrating this time two additional control variables. Through those econometric models, the overall effectiveness of the new approach is compared to the previous one.

3.1 Initial SVAR Country Model

In this first SVAR modelling, two initial country SVAR models are run for purposes of studying dynamics of sanction indexes on the Russian economy. Our goal is to demonstrate improvements brought by the new sanction index. To do so, a model (A) integrating the new sanction index will be compared to a model (B) that uses the previous sanction index. These models' OIRFs and FEVDs will be compared.

3.1.1 Database

To illustrate consequences of sanctions on the Russian economy, data have been collected from January 2010 to July 2018 on a monthly frequency. Most of our variables are linearised except for the new and previous sanction index. Unit root

⁸⁶ As GDP data are not expressed in monthly frequency, it has been decided to use the Industrial Price Index instead.

tests have been done and show that our variables are stationary in first difference, except for the new sanction index that is stationary at levels.

1. st : New sanction index in raw value.
2. d_sww : Previous sanction index.
3. dln_eru : Rouble real effective exchange rate (RREER), from the IMF.
4. dln_oilp : Brent oil price, from Intercontinental Exchange.
5. dln_ipi : Russian industrial price index, ROSTAT.

3.1.2 Model's Frame

As explained, two models are used in order to assess new features of our sanction index. According to the Cholesky ordering, our vector of endogenous variables is defined either as model (A) with the new sanction index, or as model (B) with the previous one.

$$y = (d_st \ dln_eru \ dln_oilp \ dln_ipi) \quad (A)$$

$$y = (d_sww \ dln_eru \ dln_oilp \ dln_ipi) \quad (B)$$

This paper follows the Cholesky identification method. In this identification, the ordering matters and depends on our assumptions. It is assumed that international economic sanctions affect the Russian GDP negatively or positively. Yet, as sanctions are not the main determinant of Russian GDP, oil prices and RREER are integrated. For these reasons, the causal ordering of variables will be:

$$d_st \rightarrow dln_eru \rightarrow dln_oilp \rightarrow dln_ipi \quad (A)$$

$$d_sww \rightarrow dln_eru \rightarrow dln_oilp \rightarrow dln_ipi \quad (B)$$

By doing so, sanction index is ordered first and acts as causal variable, meaning that it contemporaneously influences other variables without being impacted by them. The variable of interest is the industrial price index. It is affected by all variables without influencing them. Finally, both rouble real effective exchange rate and oil price are control variables, as they have contemporaneous effects on our variable of interest.

3.1.3 *New Sanction Index*

Firstly, the analysis of impulse response functions shows that a positive shock of sanctions induces negative effects on rouble real effective exchange rate. These effects take place over the short-term and are introduced by the sanction index's restrictions. They may lessen the rouble's demand, and in turn depreciate it. Moreover, as the Russian economy is a commodity export-led economy, any negative RREER variations should make oil or commodity production profitable, mostly as the combination of a transitory sanction shock and RREER variation shall decrease oil price over the short-term. Finally, the sanction's shock has negative outcomes on Russian production as its negative effects last for up to three months after the transitory positive shock. From a statistical viewpoint, both RREER and oil price variables reacts significantly to a positive shock of sanctions in the short-term. Respectively, it happens during the first and second months for both variables, as confidence intervals do not include the zero line. It means that sanctions affect both variables negatively on the short-term. Nevertheless, results on our variable of interest are unclear. As previously noticed, a sanctions' shock has a persistent negative effect on the Russian GDP, even if not significant. This can mostly be explained by the economy adjustment hypothesis, based on both import-substitution strategy of Russia and changes in Russian international trade structure. Secondly, the Variance decomposition of forecast errors (FEVD) shows that the variability of endogenous variables follows OIRFs' main results, mostly as both RREER and oil price variations over time are explained by sanctions variations (respectively for 7.5% and 11.7%). Finally, results show that up to 5% of Russian GDP variability over time is explained by the new sanction index. Yet, as noticed earlier on OIRFs results, sanctions do not affect the evolution of Russian production effectively.

TABLE II-2
FEVD: PERCENTAGE CHANGES OF VARIABLES
EXPLAINED BY THE NEW SANCTION INDEX

<i>Variables</i>	<i>1 month</i>	<i>5 months</i>	<i>10 months</i>	<i>20 months</i>
<i>reer_t</i>	7.0	7.0	7.2	7.5
<i>oilprice_t</i>	5.0	8.9	10.3	11.7
<i>gdp_t</i>	1.7	5.0	5.0	5.0

3.1.4 Previous Sanction Index

This subsection is dedicated to model (B), which is based on the previous sanction index. To get started, OIRF's results reveal that general trends previously noticed in model (A) remain. Indeed, both RREER and oil price react negatively to a transitory positive sanctions shock. Nevertheless, unlike previous results, RREER and oil price suffer from a lack of significance. Regarding Russian GDP, results show that a positive sanctions shock induces contradictory consequences on Russian production. It seems to stimulate domestic production positively rather than negatively –over the short-term. However, as the previous index does not take into account the adaptability of Russian's economy, it appears that effects on variables last longer over time. Certainly, because outcomes on oil price continues from 5 to 6 months for RREER and oil price variables, and up to 5 months for Russian's GDP. Finally, FEVD results imply inconsistent outcomes through a reduction of explanatory power of sanction innovations on other variables variations. Indeed, only 4.4%, 4.1% and 0.6% are explained by fluctuations of the sanction index over time (respectively for RREER, Oil price and Russian GDP).

TABLE II-3
FEVD: PERCENTAGE CHANGES OF VARIABLES
EXPLAINED BY THE PREVIOUS SANCTION INDEX

<i>Variables</i>	<i>1 month</i>	<i>5 months</i>	<i>10 months</i>	<i>20 months</i>
<i>reer_t</i>	0.3	4.3	4.4	4.4
<i>oilprice_t</i>	0.0	4.1	4.1	4.1
<i>gdp_t</i>	0.0	0.6	0.6	0.6

3.1.5 Comparison

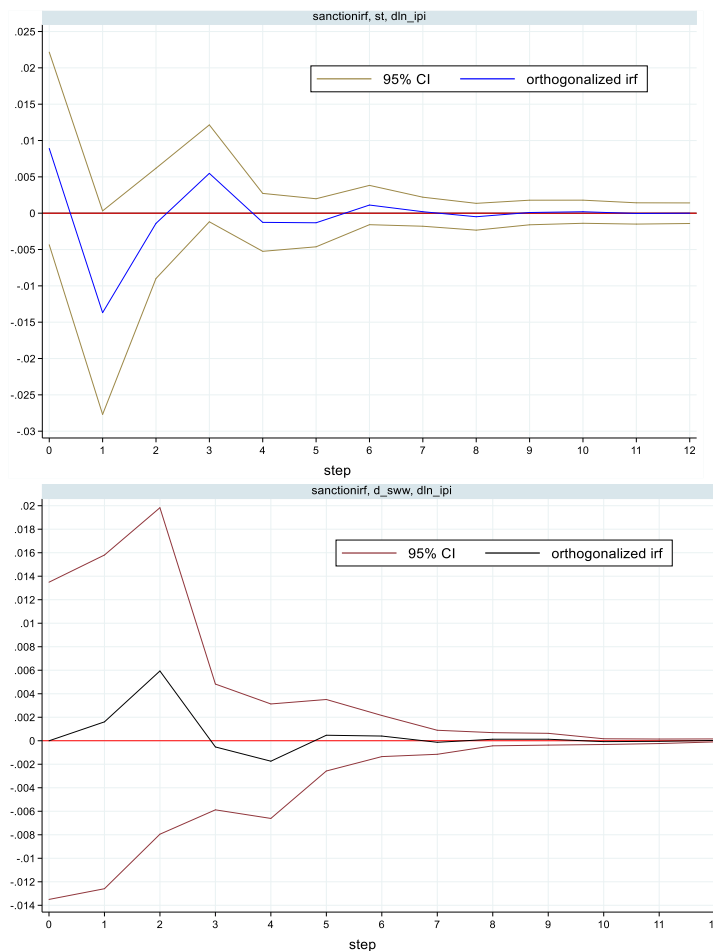
As our main goal is to compare outcomes on the most dependent variable (Russian GDP) through models (A) and (B), comparison analysis focuses on both models' FEVD results. What do FEVD results say? It seems that using the new sanction index enhances models' explanatory power. For instance, sanctions in model (A) reach more than 5% of explanatory power, while sanctions in model (B) remain on the ground with less than 1%. This means that the new sanction index is able to justify Russian GDP's variation at least five times more than the previous sanction index. These results show that the new sanction index developed in this

paper improves models' accuracy. To be precise, it affects Russian production variations on the short-term more sharply than the previous sanction index. In order to ensure the reliability of the initial result regarding improvements brought by the new index, a second extended model is introduced in the next section.

TABLE II-4
FEVD: COMPARISON BETWEEN MODELS A AND B (PERCENTAGE)

<i>Steps/months</i>	<i>Impulse (st)</i>	<i>Impulse (sww)</i>
	<i>Response (ipi)</i>	<i>Response (ipi)</i>
	<i>Model (A)</i>	<i>Model (B)</i>
1	1.7208	4.60E-07
5	5.0401	0.6945
10	5.0536	0.6966
15	5.0541	0.6967
20	5.0541	0.6967

GRAPH II-2
ORTHOGONALIZED IMPULSE RESPONSE FUNCTION, COMPARISON (A) VS (B)



Notes: Figures are the industrial price index implied responses to a sanction shock in model (A) on the left, and in model (B) on the right.

3.2 Extended SVAR country models

Previous section allowed us to put forward key results regarding differences between the new and previous sanction indexes. It is nonetheless important to run two additional models in order to confirm previous improvements. Some might be willing to consider this section as a robustness test. Thus, two extended country SVAR models will be studied in this section. Indeed, model (C) and (D) are augmented by the arrival of two additional control variables: domestic capital flows and exports.

3.2.1 Database

Models developed in this section are based on previous implementations, with two additional control variables. In addition, period span and frequency remain as in the initial SVAR country model. Russian exports variable is linearised and turned in first difference to ensure stationarity, while capital flows are transformed in growth rates.

1. g_cf : Capital flows balance, as a growth rate for consistency purposes, from the Bank of International Settlements.
2. dln_xru : Russian exports, from ROSTAT.

3.2.2 Model's Frame

Adding two additional control variables naturally leads to a six endogenous variables country SVAR model. As before and for the same reasons, Cholesky decomposition ordering is used in this section. This time, our vector of endogenous variables is defined either as in model (C) with the new sanction index, or (D) with the previous sanction index.

$$y = (d_st \ dln_eru \ dln_oilp \ dln_xru \ g_cf \ dln_ipi) \quad (C)$$

$$y = (d_sww \ dln_eru \ dln_oilp \ dln_xru \ g_cf \ dln_ipi) \quad (D)$$

The ordering of endogenous variables follows the same logic as earlier. It is assumed that economic sanctions have an impact on Russian industrial price

index. Thus, two additional control variables are added in order to increase the robustness of our results.

$$d_{st} \rightarrow dln_{eru} \rightarrow dln_{oilp} \rightarrow dln_{xru} \rightarrow g_{cf} \rightarrow dln_{ipi} \quad (C)$$

$$d_{sww} \rightarrow dln_{eru} \rightarrow dln_{oilp} \rightarrow dln_{xru} \rightarrow g_{cf} \rightarrow dln_{ipi} \quad (D)$$

Thus, industrial price index is now contemporaneously impacted by sanctions (our causal variable), as well as four other control variables. It means that an impulse of sanctions with a response of industrial price index will include effects of REER, oil price, Russian exports, and capital flights.

3.2.3 *New Sanction Index*

According to OIRFs results, the introduction of two complementary variables leads to mixed results. Indeed, a transitory sanction's shock induces similar results as models (A) and (B). As previously discovered, a transitory shock of the new sanction index induces negative outcomes on RREER and oil price over the period following the transitory shock. In addition, such a shock seems to negatively impact the complementary variables. Yet, Russian exports decrease more clearly over the short-term than capital flows. Moreover, capital flows are not effectively affected by sanctions. Finally, our variable of interest follows previous models' trends as OIRFs reveal that Russian GDP reacts negatively to sanctions' shock. Nevertheless, from a statistical perspective, it is vital to bear in mind that OIRFs results are significant for oil price and exports, but not for Russian GDP.

TABLE II-5
FEVD: PERCENTAGE CHANGES OF VARIABLES EXPLAINED BY THE NEW
SANCTION INDEX

<i>Variables</i>	<i>1 month</i>	<i>5 months</i>	<i>10 months</i>	<i>20 months</i>
<i>reer_t</i>	5.9	6.1	6.3	6.6
<i>oilprice_t</i>	5.2	8.5	9.9	11.2
<i>export_t</i>	0.2	4.4	4.8	5.2
<i>capflows_t</i>	0.2	0.4	0.5	0.5
<i>gdp_t</i>	1.0	4.7	4.8	4.8

The FEVD analysis shows important differences regarding endogenous variables variability explained by the sanctions variable. Indeed, up to 6.6%, 11.2% and 4.8% of respectively RREER, oil price and Russian GDP variations are explained by

sanctions. It means that the introduction of complementary variables reduces sanctions explanatory power.

3.2.4 Previous Sanction Index

Regarding OIRFs, only oil price reacts significantly to a transitory positive shock of the original sanction index, while all remaining variables are not significant. The most dependent variable also shows contradictory results as the transitory shock induces positive outcomes instead of reducing Russian production over the short-term. Moreover, results regarding Russian GDP also suffer from a lack of significance.

TABLE II-6
FEVD: PERCENTAGE CHANGE OF VARIABLES EXPLAINED BY THE PREVIOUS SANCTION INDEX

<i>Variables</i>	<i>1 month</i>	<i>5 months</i>	<i>10 months</i>	<i>20 months</i>
<i>reer_t</i>	0.0	3.3	3.4	3.4
<i>oilprice_t</i>	0.0	3.7	3.9	3.9
<i>export_t</i>	0.0	3.7	3.6	3.6
<i>capflows_t</i>	1.2	3.8	3.8	3.8
<i>gdp_t</i>	0.0	0.6	0.7	0.7

According to FEVD table, two trends emerge from these results. Firstly, the introduction of complementary variables decreases the explanatory power of sanctions comparatively to models (A) and (B), especially for oil price and RREER variables. Secondly, it is confirmed that results regarding the most dependent variable follow findings of model (B) –only 0.7% of the original sanction index explains Russian GDP variations (in accordance with last section findings).

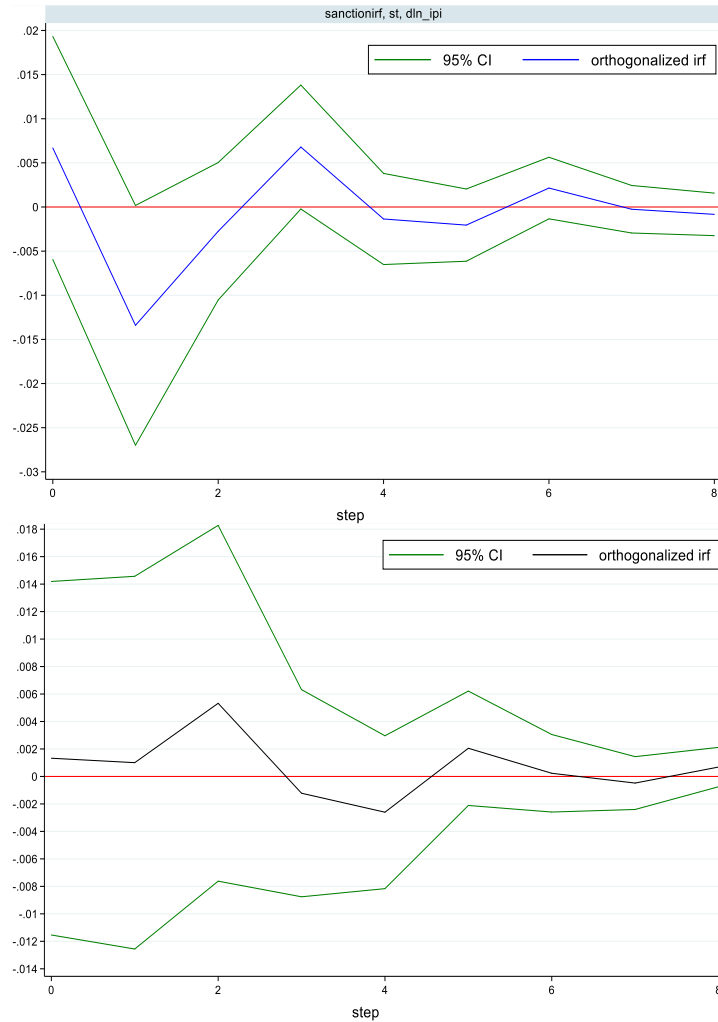
3.2.5 Comparison

TABLE II-7
FEVD: COMPARISON BETWEEN MODEL C AND D (%)

<i>Steps/months</i>	<i>Impulse (st)</i>	<i>Impulse (sww)</i>
	<i>Response (ipi)</i>	<i>Response (ipi)</i>
	<i>Model (C)</i>	<i>Model (D)</i>
1	1.0724	0.0413
5	4.7352	0.6737
10	4.8014	0.7434
15	4.8015	0.7453
20	4.8018	0.7453

According to FEVD, model (C) has a stronger explanatory power than model (D). Indeed, while the new sanction index can explain 4.8% of Russian GDP variations, the previous one crawls to 0.7%, reinforcing the new sanction index preponderance.

GRAPH II-3
ORTHOGONALIZED IMPULSE RESPONSE FUNCTION, COMPARISON (C) VS (D)



Notes: Figures are the industrial price index implied responses to a sanction shock in model (C) –upper figure, and in model (D) –lower figure.

4. Conclusion

In order to assess improvements brought by the new sanction Index, four-country SVAR have been run. The first section “Initial SVAR Country Model” focused on four variables SVAR models. Sanction indexes as causal variable were ordered first, RREER and Brent oil price were second (as control variables), and Russian industrial price index was last. Russian industrial price index (as a proxy of Russian GDP) was the most endogenous variable, and consequently the variable of interest. Model (A) was integrating the new sanction index, while model (B) used the previous sanction index. The second section “Extended SVAR country models” followed first section’s structure, but witnessed the arrival of two additional control variables: domestic capital flows and exports. Thence, it led to the run of models (C) and (D). The first one was using the new sanction index while the second one used the previous sanction index. That being said, results of the first section –with two control variables– reveal that the new sanction index has a 4 % points stronger explanatory power than the previous one. Also, it seems that our index affects short-term Russian production variations sharper than its predecessor. Improvements of the explanatory power are confirmed by the second section, supporting our index relevance.

Even if improvements made regarding variance decomposition of forecast errors are already a huge step forward, more can be said. For instance, the lack of significance illustrated by confidence-interval values –which could at first glance appear as a negative point, is a result by itself. It means that sanctions do not significantly influence Russian GDP. Hence, our study also emphasises that sanctions have a residual impact on Russia’s production. Several recent papers confirm this intuition, spotlighting that oil price is the main determinant of Russian production, see [Korhonen et al. \(2018\)](#), [Tyll et al. \(2018\)](#), *et cetera*. To conclude, it seems that the new sanction index can be used as a real econometric tool to assess sanctions impacts, even if it is true that it still has several limits, such as the heuristic on which its basic values are built.

III

Econometric Modelling & Results

Abstract

This chapter holds the econometric content of this thesis. The sanction index created in Chapter II is used as causal variable in 342 country structural vector autoregression models (CSVAR). Models cover twenty-nine countries in total, that is the European Union and Russia. Trade as much as economic growth is examined, and it appears that sanctions do not affect them directly. Nonetheless, forecast error variance decomposition results show robust evidence of the *sanction ripple effect*, defined as economic disruptions emerging from the overall business climate deterioration due to an economic conflict, even within sectors that are not covered by any economic coercive measures.

1. Introduction

In Chapter I, the study of the most recent papers that examine economic implications of the Ukrainian crisis led to the conclusion that effects of European coercive measures are mixed. The incidence of the collapse of Brent oil price –itself depreciating the Russian currency– muddies the waters and complicates economic studies. Financial and monetary implications of coercive measures are even more scattered. Indeed, it would be quite presumptuous to assume that it is possible to associate Russia’s state interventionism to international sanctions. Mostly because it is certain that Russia would have had to intervene in order to support its economy –consequently to the Russian Rouble’s depreciation, even if sanctions would have not been implemented, see [Davis \(2016\)](#), [Jones and Whitworth \(2014\)](#), [Aalto and Forsberg \(2016\)](#), [Ashford \(2016\)](#), [Harrell and Rosenberg \(2016\)](#), and [Nikulina and Kruk \(2016\)](#).

Thus, it wouldn’t make much sense to run econometric models in order to measure effects of state interventionism (as the use of Welfare Fund and the drop of Russia’s foreign reserves), since the initiating event is not related to coercive measures implemented against Russia –sanctions didn’t cause the fall of oil price. For the same reasons, it has been decided to set aside effects related to the oil industry downturn. It also seems crystal clear that the main initiating event of capital flight is the decrease of Brent oil prices, which itself led to a consequent depreciation of the Russian currency, see [Anton \(2015\)](#). Regarding Russia’s oil sector, it has somehow been protected by international sanctions since these measures stunted the petrol rush in western Siberia, Barents and Kara Seas, Timan-Pechora, eastern Siberia and Sakhalin. Hence, the petroleum industry was exempted to sell at a loss; brownfields in areas aforementioned are extremely costly, and the oil price collapsed along with the implementation of international sanctions against Russia.

Things are trickier about trade between the EU and Russia. If one compares the value of total exports of the EU to Russia between 2012 and 2018, he shall find that 2018’s value is lower by 38.42b€. From a wider perspective, the difference

between the EU total exports to Russia between the witness period (from 2009m5 to 2014m8) and the test period (from 2014m9 to 2019m12) reaches -111.23b€. More specifically, this value reaches -15.63b€ for the lone under-embargo products. It is thus crucial to know if the decrease of European exports to Russia of goods untargeted by the embargo (-95.6b€) is the consequence of European sanctions or not. This matter will be studied in Subsection 2, “Trade and Sanctions: Countries of The European Union (A01)”. Besides, Russia’s exports to the EU also decreased. Indeed, comparing 2012 yearly value to 2018’s one leads to a -46.19m€ decrease. Yet, this small amount shall not be taken for granted. In a wider perspective, the EU imports from Russia between periods decreased by -219.16b€. This fact by itself is mysterious as none of the players involved implemented restrictions on Russian exports to the EU. Is it possible that this economic flow was indirectly affected by sanctions, without even being targeted by them? This question is going to be examined in Subsection “Trade and Sanctions: Russia (A02)”.

What about countries’ GDP? This matter was partially examined in [Bali \(2018\)](#), and results show that Russia is the most impacted by sanctions; Russia’s GDP quarter-on-quarter growth decreases by 3.25% after a sanction shock. In addition, European economies’ quarter-on-quarter growth seemed to be negatively impacted by their own sanctions: -0.075% for Finland, -0.025% for France, -0.0125% for Germany, -0.012% for Italy, and -0.063% for Poland. Nevertheless, this paper focused only on the six greatest European trade partners of Russia. Moreover, the sanction index that was used came from⁸⁷ Kholodilin and Netšunajev (2019). It is somehow a weakness because of this tool’s limitations, as demonstrated in Chapter Two. Consequently, Subsection (A03) “Economic Growth and Sanctions (A03)” will study effects of sanctions on GDPs of the EU countries and on Russia’s GDP.

1.1 Motives Regarding the Use of SVAR Models

In order to examine the economic impact of international sanctions, this research based its econometric part on Structural Vector Autoregression (SVAR) models, see [Sims \(1980\)](#). Such model estimates series of equation containing variables that

⁸⁷ The paper version of 2016 was used.

influence each other contemporaneously (or with lags). Nevertheless, the main motivation for the use of SVAR is that it allows us to observe effects due to changes of one variable on others. This feature is particularly adapted to the study of sanctions' economic effects as it becomes possible to isolate the lone impact of coercive measures from outcomes due to Brent oil price, currency depreciation, central bank interest rates, *et cetera*. To be precise, the AB approach introduced by [Amisano and Giannini \(1997\)](#) will be used. As in traditional VAR, variables are regressed on a constant and on a certain number of their own lags, as much as on those of other variables. Through the AB-SVAR, a non-recursive orthogonalisation of the error terms is obtained for impulse-response analysis. Thus, error terms are not correlated.

Concretely, in the covariance matrix B, all elements out of the diagonal of the matrix are restricted to zero. Consequently, structural shocks are uncorrelated, which means that economic shocks influencing the dynamic of variables are independent from each other. Bernanke (1986) explains that as these shocks don't have common causes, it seems rational to treat them separately. For instance, in our research, it would be hard to assume that a currency shock (such as the rouble depreciation) shall be related to changes in European countries' labour productivity. Besides, impulse response functions (IRF) allow to simulate a shock on a lone variable (i.e. the impulse), and to observe its effects on others (i.e. the response). Consequently, it is possible to measure variables' variations resulting in an independent shock. For example, it would be coherent to simulate a shock in the sanction index –as the implementation of new sanctions– in order to observe the reaction of the EU exports to Russia.

In any event, it doesn't imply that there is no contemporaneous correlations between variables in the SVAR model. Moreover, contemporaneous restrictions are imposed on correlations between variables, following either theoretical assumptions or causality considerations (Granger test of causality). The SVAR thus allows variables to have contemporaneous effects on each other. It means that the variation of one variable can lead to changes on another variable at a different period of time. For instance, if the EU ban on exports of energy-related

equipment to Russia shall not affect Russia's oil revenues right after the sanctions' implementation, it is yet possible to start to observe effects through the quarter. This feature fits perfectly the reality that surrounds economic coercive measures. Even for one of the most severe measures, let's say a sectorial embargo, there would still be a lag between the embargo announcement and its field implementation.

1.1.1 Country SVAR (CSVAR)

This research examines the economic impact of international sanctions in the Ukrainian Crisis case. The emphasis is on European sanctions against Russia. To treat equally what is equal, it seems rational to produce one model for each country involved, that is the twenty eight economies of the EU and Russia. This is not only a matter of logic and coherence. Indeed, from an econometric perspective, treating countries separately can provide slightly different results than the comparison of a sum of countries (the EU) with a lone economy (Russia). This intuition has been demonstrated in Bali (2018). Indeed, studying sanctions effects on the Euro Area GDP (as a sum of 19 GDP), led to the conclusion that sanctions have a positive effect (since the Euro Area GDP increases by +0.0125% in reaction to a 1% sanction shock). Yet, the same sanction shock decreased the GDP of the six greatest European trade partners of Russia by -0.0125% (in this case a sum of 6 GDP was used). Finally, when doing CSVAR, results were once again different since the same sanction shock this time decreased France's GDP by -0.025% or Poland's one by -0.063%. There is thus no doubt that the use of CSVAR allows to obtain sharper results when studying sanctions' impact.

Each subsection has its own framework that characterises which variables will be used. Furthermore, models of one subsection have the same vector of endogenous variables. For instance, in Subsection 2, "Trade and Sanctions: Countries of The European Union (A01)", the 28 models ran (for each European country) have the same variable of interest (exports to Russia), control variables (key interest rate, real effective exchange rate, harmonised index of consumer prices, labour productivity, producer prices in industry, the exchange rate of each country's currency against the rouble), and causal variable (the sanction index). The main assumption behind this is that theoretical determinants of exports are the same

within each country. If it is true that this is a strong assumption, it is nonetheless necessary in order to obtain homogenous results. Indeed, the use of different variables depending on each country implies dissimilar models and thus results that are consequent to models' set-up in addition to contemporaneous changes in the sanction index.

1.2 Structural Vector Autoregression Modelling

As many SVAR models are going to be run in this research, it seems essential to provide details about the general model that is used. Let's consider a reduced VAR form of p order which exclude deterministic terms:

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + e_t \quad (1)$$

Where $\Sigma = E(e_t, e_t')$ the errors' covariance matrix, A_j are $k * k$ coefficients matrices for ($j = 0, 1, \dots, p$) that hold the lagged interactions among variables, e_t are a ($K * 1$) vector of error terms, and y_t a ($K * 1$) vector of K endogenous variables (for $k = 1, \dots, K$):

$$y_t = [y_1, \dots, K] \quad (2)$$

As the primary VAR model in (1) doesn't allow for contemporaneous relationship among variables, it has to be modified and can be written as:

$$A y_t = A_1^* y_{t-1} + \dots + A_p^* y_{t-p} + e_t \quad (3)$$

A new notation A_j^* is introduced because $A_j \neq A_j^*$ when $A \neq I$; matrix A contains contemporaneous relations between endogenous variables in the VAR.

However, model (3) is still based on the reduced-form VAR and its error terms will, in general, be correlated. It means that a shock on one equation is connected to other equations. This is a problem because in the studying of economic sanctions, it is essential to be able to hold other shocks constants to isolate the lone effects of coercive measures. To solve this issue, it is necessary to decompose error terms in mutual orthogonal shocks. Thus, error terms (e_t) are assumed to be linearly related to structural shocks (ε_t):

$$e_t = \mathbf{B}\varepsilon_t \quad (4)$$

\mathbf{B} is a $(k * k)$ structural form parameter matrix. It contains structural coefficient representing effects of structural shocks (ε_t) . Hence, it is assumed that $\varepsilon_t = [\varepsilon_t^{y_1}, \varepsilon_t^{y_2}, \dots, \varepsilon_t^{y_K}]$ is a $(K * 1)$ vector of serially uncorrelated residuals with zero mean ($E(\varepsilon_t) = 0$), which thus follows a white noise process. Consequently, it is imposed that $\Sigma = E[\varepsilon_t, \varepsilon_t'] = I$. The combination of (3) and (4) leads to:

$$\mathbf{A}y_t = A_1^*y_{t-1} + \dots + A_p^*y_{t-p} + \mathbf{B}\varepsilon_t \quad (5)$$

Model (5) is thus a Structural VAR that includes correlation among endogenous variables and with uncorrelated error terms. As it is, this model can't be directly estimated to derive the best estimate of parameters' values. This is why it is necessary to obtain its reduced form through the premultiplication by A^{-1} :

$$y_t = A^{-1}A_1^*y_{t-1} + \dots + A^{-1}A_p^*y_{t-p} + A^{-1}\mathbf{B}\varepsilon_t \quad (6)$$

The introduction of the new notation $A'_j = A^{-1}A_j^*$ then leads to:

$$y_t = A'_1y_{t-1} + \dots + A'_py_{t-p} + A^{-1}\mathbf{B}\varepsilon_t \quad (7)$$

Moreover, $u_t = A^{-1}\mathbf{B}\varepsilon_t$ is the vector of reduced-form VAR residuals that are not correlated with endogenous variables contained in y_t , thus:

$$y_t = A'_1y_{t-1} + \dots + A'_py_{t-p} + u_t \quad (8)$$

Finally and on the basis of the work of [Amisano and Giannini \(1997\)](#), the AB model is introduced as :

$$\mathbf{A}u_t = \mathbf{B}\varepsilon_t \quad (9)$$

Where u_t is a $(K * 1)$ vector of structural innovations that is orthogonal since its covariance is $E[u_t, u_t'] = I$, and ε_t a $(K * 1)$ vector of reduced-form residuals. The identification of structural form parameters is done by imposing linear restrictions on matrices \mathbf{A} and \mathbf{B} .

1.2.1 Identifying Restrictions on Matrices

This research is running 342⁸⁸ CSVAR models through three subsections. Each subsection has a specific framework and its own variables. For homogeneity purposes, models run within a subsection have the same variables. Thus, it has been decided to follow a specification logic based on the ordering. By doing so, vectors of endogenous variables follow a causal order. The causal variable is always at the first place, and will always be the sanction index. It is thus assumed that sanctions can contemporaneously affect all variables. The variable of interest will always be ordered last. It means that all other variables contemporaneously affect this variable, without being affected by it. To this extent, the remaining variables are control variables and thus determinants of the variable of interest. Therefore, all elements over the diagonal of matrix A are restricted to zero while elements below this diagonal are estimated. For example, if $k = 3$ equation (9) becomes:

$$\begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} \\ \mathbf{a}_{21} & \mathbf{1} & \mathbf{0} \\ \mathbf{a}_{31} & \mathbf{a}_{32} & \mathbf{1} \end{bmatrix} u_t = \begin{bmatrix} \mathbf{b}_{11} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{b}_{22} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{b}_{33} \end{bmatrix} \varepsilon_t \quad (10)$$

From this basis, it seemed rational to add further restrictions under the diagonal of matrix A in order to witness the fact that control variables might contemporaneously affect each other in a reverse manner. In other words, one variable might be affected by those ordered before her. Yet, as the only thing that is interesting to us is the outcome of an impulse of the causal variable on the variable of interest, it is highly likely that these additional restrictions would not affect our results. To be certain of this, the 28 CSVAR models of subsection (A01) have been estimated twice. Firstly with restrictions imposed as in (10) with $k = 9$; secondly with additional restrictions under matrix A's diagonal, depending on theoretical assumptions which all passed Granger causality tests (see Appendix III-1). Results are unequivocal: a sanction shock will lead to similar changes in exports to Russia, whether additional restrictions are introduced under Matrix A's diagonal or not. This is demonstrated by orthogonalized impulse-response tables, and by forecast error variance decomposition tables. The details of models run with

⁸⁸ 28 models in (A01) + 28 for reduced SVAR ; 28 models in (A02) + 28 reduced models ; 28 models in (A03) + 28 reduced SVAR, and 2 additional for Russia + 2 reduced SVAR. See Chapter's endnote for the 170 models left.

restrictions under Matrix A's diagonal are in Appendix⁸⁹ III-2, and those run without additional restrictions are in Appendix⁹⁰ III-3.

Another possibility would have been to estimate parameters over Matrix A's diagonal, while simultaneously adding an equivalent⁹¹ number of restrictions under Matrix A's diagonal. It has been tried in subsection (A01)'s framework, with the help of Granger causality tests and theoretical concerns. Nonetheless, this idea has been left behind for two reasons. Firstly, if it does indeed induce that each model will have its own specification and thus probably lead to more faithful results, it would also create a bias in results' interpretation. Thence, it would be impossible to follow the CSVAR logic explained earlier as results would mostly depend on each model's specification in addition to changes in the sanction index. One would ineluctably end up comparing apples with oranges. Secondly, such specifications often led to a situation where the likelihood function is difficult (if not impossible) to maximize because of nonconcave regions⁹². The *Maximum Likelihood Estimation* algorithm fails to work well. Fixing this issue for each model would itself require a consequent research that is out of this thesis' scope. This door is left open and could be considered as an interesting robustness check to conduct in future. As a consequence of the above and with full consciousness of possible ramifications, Matrix A's specification remains as in (10).

2. Trade and Sanctions: Countries of The European Union - (A01)

Trade between the EU and Russia decreased slightly after the implementation of European sanctions and Russian counter-sanctions. Yet, the bulk of the decrease is recorded by products that aren't targeted by sanctions. To be precise, 85.95% of the decrease of exports from the EU to Russia concerns goods untargeted by the

⁸⁹ Appendix III-2a contains SVAR results, Appendix III-2b contains IRF results, and Appendix III-2c contains FEVD results.

⁹⁰ Appendix III-3a contains SVAR results, Appendix III-3b contains IRF results, and Appendix III-3c contains FEVD results

⁹¹ It is essential to keep this equilibrium since the maximum number of identifiable parameters in matrices A and B is $\frac{K(K+1)}{2}$, and as there are $2K^2$ parameters in total, the order condition for identification requires that $2K^2 - \frac{K(K+1)}{2}$ restrictions shall be placed on the elements of matrices A and B for an exact identification, [Breitung et al. \(2004\)](#).

⁹² Some iterations are not concave, probably because of the relatively small number of observations (67 in subsection A01).

Russian embargo. If it is true that there is indeed a ban on providing goods in Crimea related to transport, telecommunications and energy sectors such as the exploration of oil, gas, and mineral resources, these measures can easily be circumvented. Herewith, it would just require to send targeted goods elsewhere in Russia (out of Crimea) for re-exportation motives. In addition, if there is indeed a prohibition to export arms and materials for military use in Russia, these products have a ridiculously low weight in trade between the EU and Russia; exports of arms and ammunition reach, in average, 0.046% (43.18m€) of total exports of the European Union to Russia between 2009 and 2019 (average yearly value, see Table III-1). Regarding the prohibition to export dual-use goods to Russia, to the author's best knowledge, there is not a clear list containing SITC numbers of goods that would allow one to produce statistics. In fact, it is even written in Commission Notice of 25.9.2015 (Appendix III-4) that:

“Primary responsibility for the classification of goods and technologies lies, however, with those responsible for sending or receiving such items.” (Commission Guidance note on the implementation of certain provisions of Regulation (EU) No 833/2014, p. 3).

In other words, economic actors shall check legal text and find, somehow, whether products that they wish to export to Russia might be considered as dual-use goods or not. It would not be irrational to say that there is a real failure in the implementation of this very precise measure. Consequently, dual-use goods are not included in Table III-5 and will not be isolated from other products in our calculation. Finally, if exports of energy-related (mainly deep-water oil exploration) equipment to Russia are either banned or submitted to authorization, the EU still fails to precise which SITC (or any other trade classification) subsubsection are precisely targeted. Responsibility is again delegated to economic actors.

TABLE III-1
EU EXPORTS TO RUSSIA: SHARE OF ARMS AND AMMUNITION

<i>Year</i>	<i>Total Exports</i>	<i>Arms & Ammunition</i>	<i>Share of Arms & Ammunition</i>
2009	65696.698	47.423	0.072%
2010	86327.989	52.195	0.060%
2011	108559.447	56.378	0.052%
2012	123506.042	73.291	0.059%
2013	119468.419	70.003	0.059%
2014	103281.685	50.001	0.048%
2015	73786.205	29.330	0.040%
2016	72368.518	20.065	0.028%
2017	85991.254	25.532	0.030%
2018	85103.458	26.140	0.031%
2019	90797.367	24.669	0.027%
Average	92262.462	43.184	0.046

Data source: Eurostat

2.1 Architecture

As explained, the emphasis will be placed on the EU exports to Russia net of goods⁹³ targeted by the Russian embargo (see Appendix III-5) and net of arms and ammunition (SITC 891). The goal is to check if products out of the embargo's range were impacted by European measures against Russia. It could be some kind of **sanction ripple effect**, which is defined here as “*economic disruptions emerging from the overall business climate deterioration due to an economic conflict, even within sectors that are not covered by any economic coercive measures*”. The study period of this subsection starts in 2003q1 and ends in 2019q4. Its frequency is quarterly and thus gathers 67 observations⁹⁴.

2.1.1 Framework

Let's define y_t (for $t = 1, \dots, 67$) a vector of endogenous variables as follows:

$$y_t = (SE_t \ ML_t \ REER_t \ HICP_t \ LP_t \ PPI_t \ ER_t \ FI_t \ XRU_t) \quad (11)$$

⁹³ Such database doesn't exist. Goods targeted by the embargo had to be extracted one by one from Eurostat database. Yet, it is the total sum of these goods that is interesting to us. However, the problem was that some series had missing data, making impossible to sum them all. Thus, it was necessary to deal with these missing values in order to create a database that is the total sum of these goods. As these data follow a random walk, missing values have been replaced by “0”.

⁹⁴ From 2003q1 to 2019q4 there are 68 observations in total, but the first one (2003q1) is a missing value, since our series are growth rates.

It integrates seven domestic variables (country-specific) and two external variables. Exports to Russia (XRU_t), harmonised index of consumer prices ($HICP_t$), labour productivity (LP_t), producer prices in industry (PPI_t), exchange rate of the considered country's currency against the Russian rouble (ER_t), marginal lending key interest rate (ML_t) and real effective exchange rate ($REER_t$) are domestic variables. European sanction index (SE_t) and foreign income (FI_t) –proxied by the Russian GDP– are external variables. Exports to Russia is ordered last as it is the variable to be explained, and the sanction index is ordered first as it is the causal variable; variables in-between are control variables. According to our CSVAR methodology, all models in this subsection follow this vector of endogenous variables. The exact number of models is 28 since the European Union at the Ukrainian crisis time had 28 members⁹⁵. Consequently, equation (11) becomes:

$$y_{t,i} = (SE_t \ ML_{t,i} \ REER_{t,i} \ HICP_{t,i} \ LP_{t,i} \ PPI_{t,i} \ ER_{t,i} \ FI_t \ XRU_{t,i}) \quad (12)$$

European countries are ranked by alphabetical order using their country code⁹⁶ (Table III-2), and their attributed number ($i = 1, \dots, 28$) will never change through this entire chapter.

TABLE III-2
EUROPEAN COUNTRY CODES AND ATTRIBUTED NUMBERS

<i>Country Code</i>	<i>Country Name</i>	<i>Attributed i number</i>	<i>Country Code</i>	<i>Country Name</i>	<i>Attributed i number</i>
AT	Austria	1	HU	Hungary	15
BE	Belgium	2	IE	Ireland	16
BG	Bulgaria	3	IT	Italy	17
CY	Cyprus	4	LT	Lithuania	18
CZ	The Czech Republic	5	LU	Luxembourg	19
DE	Germany	6	LV	Latvia	20
DK	Denmark	7	MT	Malta	21
EE	Estonia	8	NL	Netherlands	22
ES	Spain	9	PO	Poland	23
FI	Finland	10	PT	Portugal	24
FR	France	11	RO	Romania	25
GB	The United Kingdom	12	SE	Sweden	26
GR	Greece	13	SI	Slovenia	27
HR	Croatia	14	SK	Slovakia	28

⁹⁵ Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland.

⁹⁶ ISO 3166 Alpha-2 code.

2.1.2 Choice of Variables

Variables have been selected on the basis of theoretical and empirical evidence. Several papers studying the determinants of exports have been examined, providing great guidance to the variable selection.

- **Marginal lending key interest rate (ML_t) and country's currency exchange rate against the Russian rouble (ER_t):** Key interest rates can influence exports through the monetary transmission mechanism [Christiano and Eichenbaum \(1992\)](#). Hence, there is a relationship between changes in key interest rates and exchange rates appreciation or depreciation, see [Conway \(1998\)](#), [Calvo and Reinhart \(2002\)](#) or [Jeanne and Rose \(2002\)](#). As clearly explained in [Lahiri and Végh \(2002\)](#), lending rates witness a similar relationship since a rise in key interest rates also leads to a rise in lending interest rates, reducing bank credit and output contracts. Because of the higher competition on financial market, banks have to offer higher rates on bank deposits. It thus leads to a rise in the bank deposits demand, which in turn increases the foreign currency price of the considered country's currency. Goods produced in the country are more expensive, which decreases exports. Earlier, [Lerner \(1952\)](#) studied the fact that the domestic currency depreciation leads to an exports increase. It has thus been decided to include both interest rates and exchange rates, following [Sonaglio et al. \(2016\)](#).
- **Real effective exchange rate ($REER_t$):** From another angle, it is also useful to consider how strong a country's currency can be against a basket of other currencies. It gives clues about relative prices with other trading partners, and thus potential competitors. As explained in Chapter I, most European countries are not uniquely trading with Russia. It is naturally possible that countries' currency fluctuations against other trading partners' currencies affect their exports to Russia. Quite logically, many papers studying trade include REER, see [Bournakis \(2012\)](#), [Chaudhry and Bukhari \(2013\)](#), [Lapp et al. \(1995\)](#), *et cetera*.

- **Harmonised index of consumer prices ($HICP_t$):** There is a lot of evidence of the relationship between inflation and exports in the literature, see [Sonaglio *et al.* \(2016\)](#), [Ahmed *et al.* \(2018\)](#), [Gylfason \(1999\)](#), [Lovasy \(1962\)](#), and so on. It seems that high inflation can lead to low exports, particularly if the situation within trading partners' economies remains stable. Consequently, it seems interesting to include harmonised consumer price index among control variables.
- **Labour productivity (LP_t):** Trade and labour productivity were encountered at the outset of political economics when [Ricardo \(1817\)](#) introduced its principle of comparative advantages. Later, following Ricardo's work, the Heckscher–Ohlin model also highlighted the key role factor endowments within a trading area, see [Heckscher \(1919\)](#). More recently, [Zwick \(2004\)](#) found that labour productivity matters since it allows companies to stand international competition. [Deshmukh and Pyne \(2013\)](#) also reveal the relationship between labour productivity and firms' participation in export markets through the self-selection hypothesis. This finding also appears in [Wagner \(2007\)](#) where it is stated that the most productive firms self-select themselves into the export market. Because of the above, it seems truly legitimate to integrate labour productivity as a control variable.
- **Producer prices in industry (PPI_t):** As labour productivity, this variable witnesses the role of factor endowment in trade. Instead of representing labour, producer prices in industry may represent capital. [Guillaumont and Guillaumont \(1990\)](#) clearly expose the relation between producer prices and exports. One can also assume that producer prices can affect exports by influencing the competitiveness of firms on the international scene. It thus closely follows above-stated labour productivity assumptions.
- **Foreign income (FI_t):** This variable is proxied by the Russian GDP since exports in our models head towards Russia. Foreign income is a traditional component of models studying trade. The logic is that a decrease in GDP leads to a decrease in imports (and thus foreign exports) and reversely. It is

clearly exposed in [Bournakis \(2012\)](#), [Fountas and Bredin \(1998\)](#), [Sonaglio et al. \(2016\)](#), [Shane et al. \(2008\)](#), *et cetera*.

2.1.3 Data Treatments

Since databases used in this subsection stem from several adjustment and treatments, it is crucial to provide details about them –for obvious transparency reasons. The source of data is available in Table III-3.

TABLE III-3
DATA SOURCE – (A01)

<i>Variable</i>	<i>Details</i>
$XRU_{t,i}$	Countries' Exports to Russia – Eurostat ; extracted on 03.06.20; last update 15.05.20; total exports net of arms and ammunition (SITC 891); value in euros; EU trade since 1988 by SITC [DS-018995].
$LP_{t,i}$	Labour Productivity (per hours worked) – European Central Bank ; total economy; all activities; index; chain linked volume (rebased); non-transformed data; neither seasonally adjusted nor calendar adjusted data; average of observations through period (A).
$PPI_{t,i}$	Producer Prices in Industry – Eurostat ; extracted on 04.06.20; last update 03.06.20; total - quarterly data; total output price index - in national currency; industry (except construction, sewerage, waste management and remediation activities); unadjusted data (i.e. neither seasonally adjusted nor calendar adjusted data); index, 2015=100, [sts_inpp_q].
$REER_{t,i}$	Real Effective Exchange Rate – Eurostat ; extracted on 04.06.20; last update 03.06.20; deflator: consumer price index - 42 trading partners - industrial countries; Index, 2010=100; [ert_eff_ic_q].
$ER_{t,i}$	Country's Currency Exchange Rate Against the Russian rouble – European Central Bank ; ECB reference exchange rate; average of observations through period (A).
$FI_{t,i}$	Foreign Income – Organization for Economic Co-operation and Development ; gross domestic product by expenditure in constant prices: total gross domestic product for the Russian Federation [NAEXKP01RUQ652S], retrieved from FRED, Federal Reserve Bank of St. Louis.
$HICP_{t,i}$	Harmonised Index of Consumer Prices – Eurostat ; extracted on 04.06.20; last update 29.05.20; index, 2015=100; neither seasonally adjusted nor calendar adjusted data; all items; monthly data [ei_cphi_m].
$ML_{t,i}$	ECB Marginal lending facility – European Central Bank ; euro area (changing composition); key interest rate; date of changes (raw data); level; euro; average of observations through period; percent per annum.
$SE_{t,i}$	Sanction Index (European Sanctions) – Bali et al. (2020) ; the index construction is detailed in Chapter II; index values available in Annexes, Table II-s .

To begin, $XRU_{t,i}$ and $HICP_{t,i}$ were in monthly values and had to be turned into quarterly data. Exports are the total exports (Appendix III-6) reduced by arms and ammunitions (Appendix III-7). Regarding $LP_{t,i}$, data for Belgium, Greece, Luxembourg and the United Kingdom were not available as it is in Table III-3. Thus, it was necessary to use instead:

Greece: Labour Productivity (per hours worked) - Greece - world (all entities, including reference area, including io), total economy, services, index, chain linked volume (rebased), non-transformed data, neither seasonally adjusted nor calendar adjusted data, ECB.

Luxembourg: Labour Productivity (per persons) - Luxembourg - world (all entities, including reference area, including io), total economy, total - all activities, index, chain linked volume (rebased), non-transformed data, neither seasonally adjusted nor calendar adjusted data, ECB.

The United Kingdom: Labour Productivity (per hours worked) - United Kingdom - world (all entities, including reference area, including io), total economy, services, index, chain linked volume (rebased), non-transformed data, neither seasonally adjusted nor calendar adjusted data, ECB.

Belgium: Labour Productivity (per persons) - Belgium - world (all entities, including reference area, including io), total economy, total - all activities, index, chain linked volume (rebased), non transformed data, neither seasonally adjusted nor calendar adjusted data, ECB.

It was appropriate to convert $FI_{t,i}$ from Russian rouble to euros, in order to obtain a common currency among all our series; ECB reference exchange rate has been used. No particular changes have been done to $REER_{t,i}$ and $PPI_{t,i}$. In order to obtain countries' currency against the Russian Rouble ($ER_{t,i}$), it was necessary to convert currencies of countries out of the Euro Area (EA) into Euros. Then, the euro/Russian rouble (ECB reference exchange rate) was used. This has been done for the UK pound, the Czech koruna, Danish krone, Croatian kuna, Polish zloty, Swedish krona, Hungarian forint, Bulgarian lev. Some other countries had to

follow a similar transformation as they joined the EA after 2003. For instance, on 1 January 2007 Slovenia joined the EA. Thus, data from 2007q1 are euro/Russian rouble, and its exchange rate from 2003 to 2006 are the conversion of the Slovenian tolar into euro, and then euro/Russian rouble. Similar adjustment has been done with the Cyprus pound and the Maltese lira (from 2003 to 2007), the Slovak koruna (from 2003 to 2008), the Estonian kroon (from 2003 to 2010), Latvian lats (from 2003 to 2013), and Lithuanian litas (from 2003 to 2014). The euro/Russian rouble rate is used for members of the EU that joined the EA before 2003.

Key interest rates ($ML_{t,i}$) were initially monthly data, which were turned into quarterly data. As raw data were not stationary and because it was not possible to use logarithm (too many values equal or close to 0), growth rates have been used. By the same logic as for exchange rates –because countries didn't join the EA at the same time, it has been necessary to use different databases. Thus, official lending rate was used for Denmark and short-term interest rate from the OECD for Estonia. Interbank market interest rate (ZIBOR) was selected for Croatia from the Central Bank of Croatia, and key lending rate for Sweden from Central Bank of Sweden. Day-to-day money market interest rate (averages) from Eurostat was chosen for Austria, Belgium, Bulgaria, Czech Republic, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Hungary, Netherlands, Poland, Portugal, Romania, Finland and the United Kingdom. Finally, data for Cyprus, Latvia, Lithuania, Malta⁹⁷, Slovenia and Slovakia were obtained by merging two databases: (i) day-to-day rate for Euro Area countries from Eurostat No. [irt_h_ddmr_m] (before their entry into the EA); (ii) EA day-to-day money market rate from Eurostat No. [ei_mfir_m] (once they were in the EA).

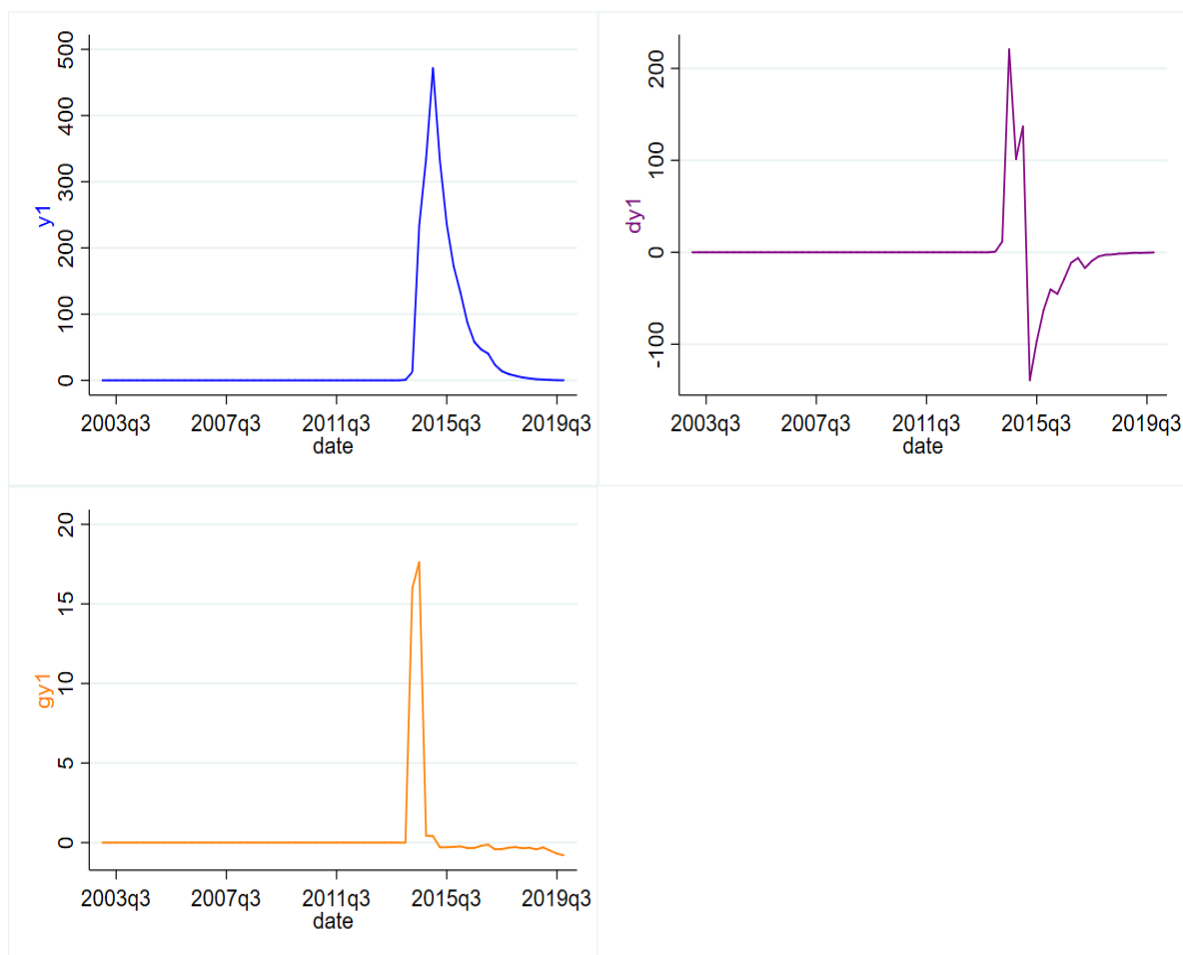
Finally, the sanction index ($SE_{t,i}$) is non-stationary in raw data, and a choice has to be made in order to know if the index will be turned into first difference or growth rate (turning it into logarithm would not be reasonable⁹⁸ as many values are equal to zero or close to it). Two facts lean in favour of the use of the growth

⁹⁷ Values of 2007m1 and 2007m4 were missing and have been replaced by marginal lending key interest rate from Malta Central Bank.

⁹⁸ $\ln(0)$ has no value, as much as $\frac{1}{0}$.

rate of the sanction index. Firstly, when expressed in a growth rate (gy_1), its behaviour is closer to its raw value (y_1) than a first differenced index (dy_1), see Graph III-1. Secondly, using a growth rate smoothes our models in the way that all variables used have a similar statistical treatment; a logarithm first-difference is a growth rate. It is thus more coherent and prevents interpretation difficulties.

GRAPH III-1
SANCTION INDEX – DIFFERENT STATISTICAL TREATMENT



2.1.4 Stationarity

All series used in our models are stationary I(1). This is checked with structural breaks Clemente-Montanes-Reyes (CMR) test for sixty-seven series, while one hundred and forty-four series do not succeed in rejecting the null hypothesis. Yet they manage to do so with DF-GLS unit root test, and six series are able to reject the presence of unit root only with the traditional ADF test. A synthesis of these results can be found in Appendix III-8, and raw results of all tests that have been run are available in Appendix III-9. As uniformity matters, it was not possible to

leave series which are $I(0)$ in raw values, while those which are $I(1)$ are either in first difference logarithm, or in growth rate. Consequently, all series follow the same treatment and are in growth rate (either directly or by logarithm first difference).

2.1.5 Lag order

Schwarz Bayesian Information Criterion (SBIC) and the Hannan–Quinn Information Criterion (HQIC) have a similar interpretation as Akaike's Information criterion (AIC), [Akaike \(1998\)](#). Nevertheless, it seems that SBIC and HQIC have a theoretical advantage over the AIC, since minimizing them (i.e. choosing the lowest value) provides consistent estimates of the true lag order, see [Lütkepohl \(2005\)](#). For this reason, when the lag value differs between SBIC/HQIC and AIC, one model for each possibility is run. The model chosen is the one providing the best IRF's confidence intervals. More details about all tests run in this subsection are available in Appendix III-10, while a synthesis is provided in Annexes, [Table III-4](#).

2.2 Results

Main results of this subsection are summarized here; interpretation will be done in this chapter's conclusion.

2.2.1 Impulse Response Function

All models (except models 8 and 19) have statistically significant IRF, since confidence intervals are either above or below zero. Models 1, 3, 5, 10, 12, 13, 14, 15, 16, 17, 18, 19, 21, 23, 28, all react negatively to a sanction shock when the shock is happening. However, this negative reaction remains a quarter further for models 13, 15, 18, 19, 23, and 28. Finally, in model 15 this negative reaction lasts for 2 quarters. Not least among these results, there are many zeros behind the decimal point (11 at step 0, 11 at step 1, and 10 at step 2). Consequently, it seems coherent to assume that the effect of a sanction shock on exports is close to zero among all countries studied. See Appendix III-3b for IRF graphs and Appendix III-3d for IRF detailed values.

TABLE III-5
IMPULSE RESPONSE FUNCTION VALUES – (A01)

<i>Model</i>	<i>Step 0</i>	<i>Step 1</i>	<i>Step 2</i>	<i>Model</i>	<i>Step 0</i>	<i>Step 1</i>	<i>Step 2</i>
1-AT	-1.5E-14	3.5E-14	5.9E-16	15-HU	-1.2E-14	-8.6E-15	-1.4E-14
2-BE	2.8E-14	1.8E-14	-1.6E-14	16-IE	-6.3E-15	9E-14	-8.3E-14
3-BG	-1.7E-14	1.4E-14	1.7E-14	17-IT	-9.7E-15	1.6E-14	-4.1E-15
4-CY	5.5E-13	-2.3E-13	-1.1E-12	18-LT	-5.1E-14	-4.2E-14	2.3E-14
5-CZ	-1.7E-13	8.1E-13	-3.1E-13	19-LU	-5E-15	-1.3E-14	3.4E-14
6-DE	4.7E-14	2.8E-14	-1E-13	20-LV	3.1E-13	-6.2E-13	2E-12
7-DK	1.7E-14	-2E-14	-2.1E-14	21-MT	-2.5E-14	1.6E-13	-2.3E-13
8-EE	2.5E-15	4.6E-15	-6.6E-16	22-NL	5.3E-14	7.5E-16	-2E-14
9-ES	1E-14	-9.7E-15	-3.7E-14	23-PO	-1.1E-16	-3.4E-15	1.6E-14
10-FI	-1E-14	7.9E-14	-1.3E-13	24-PT	3.8E-14	-2.8E-14	9.7E-14
11-FR	1.6E-13	-2.6E-13	3.2E-13	25-RO	1.8E-14	-1.3E-14	-2.5E-14
12-GB	-4.2E-14	8.8E-16	-4.9E-14	26-SE	8.6E-14	-4.9E-14	1.9E-14
13-GR	-3.5E-15	-3E-15	1.6E-14	27-SI	3.3E-14	-3.2E-14	1.8E-14
14-HR	-4.7E-15	2.4E-14	8.7E-15	28-SK	-2E-15	-4.3E-15	3.6E-14

Note: Response of exports after an impulse of sanctions.

2.2.2 FEVD

Contrarily to IRFs, there is no trend among all models regarding results of forecast error variance decomposition. Indeed, eleven models are above 80%, three models are between 80% and 50%, ten models are between 50% and 10%, and four are below 10%. Thus, in most models, a sanction shock contributes to at least 50% of unexplained variations in exports. Cyprus, Latvia, Portugal, Denmark, and United Kingdom have values above 90%. See Table III-6 for further details.

TABLE III-6
MODELS RANKING BY FEVD VALUES – (A01)

<i>Model</i>	<i>Step 1</i>	<i>Step 2</i>	<i>Model</i>	<i>Step 1</i>	<i>Step 2</i>
4-CY	0.992	0.977	5-CZ	0.416	0.537
20-LV	0.934	0.898	10-FI	0.293	0.909
24-PT	0.91	0.888	18-LT	0.286	0.345
7-DK	0.908	0.744	21-MT	0.259	0.892
12-GB	0.903	0.663	9-ES	0.212	0.09
27-SI	0.874	0.892	14-HR	0.177	0.628
22-NL	0.845	0.325	13-GR	0.14	0.059
6-DE	0.82	0.623	11-FR	0.126	0.096
26-SE	0.817	0.672	28-SK	0.121	0.22
1-AT	0.81	0.819	8-EE	0.1	0.025
25-RO	0.805	0.643	16-IE	0.017	0.056
2-BE	0.724	0.152	17-IT	0.017	0.056
3-BG	0.648	0.288	19-LU	0.003	0.014
15-HU	0.648	0.49	23-PO	5E-05	0.019

Note: Response of exports after an impulse of sanctions.

2.3 Robustness Check

In order to check results from our main framework (A01), it has been decided to run three additional sets of 28 econometric models. The first set (2.3.1) follows the same CSVAR logic, except that models are reduced to only four variables. Then comes a second set (2.3.2), which is nothing less than very basic linear regressions. Models are built with the nine variables used within. Finally, the *Bayesian approach* of linear regression is conducted through the estimation of the last set of models (2.3.3). Variables used are still as in (A01).

2.3.1 Reduced CSVAR Models – (A01a)

« Pluralitas non est ponenda sine necessitate »

In line with the principle of parsimony, it has been decided to rerun CSVAR models but this time with four variables instead of nine. Almost everything is similar to what was done in (A01) –causal ordering is used, variables treatments are similar, *etc.* Let's define y'_t (for $t = 1, \dots, 67$) a vector of endogenous variables as follows:

$$y'_t = (SE_t \ ML_t \ ER_t \ XRU_t) \quad (13)$$

Variables and data used are identical to those described in “2.1 Architecture: the sanction index (SE_t)”, marginal lending key interest rate (ML_t), exchange rate of the considered country's currency against the Russian rouble (ER_t) and exports to Russia (XRU_t). There are still 28 models, for each member of the EU during the Ukrainian crisis; equation (13) becomes (for $i = 1, \dots, 28$):

$$y'_{t,i} = (SE_{t,i} \ ML_{t,i} \ ER_{t,i} \ XRU_{t,i}) \quad (14)$$

Data treatment and stationarity remain as in 2.1.3 and 2.1.4. Lag order is naturally different since tests for VAR order determination have to be done with the new vector of endogenous variables (14). Details regarding these tests are available in Appendix III-11, while a synthesis is provided in Annexes, [Table III-7](#).

Regarding results, one shall not expect them to be identical since models are different. Nevertheless, main trends obtained from these results matter. Thus, most impulse response functions have naturally less statistical significance than in (A01). It is easy to see since confidence interval lines are furthest from orthogonalized IRF, see Appendix III-11b. Moreover, if values at step 0, 1 and 2 in (A01a) slightly increase, they are still close to zero, see Table III-8. FEVD results in (A01a) are significantly lower than in (A01). It means that a sanction shock, in average, is less likely to be responsible of unexplained changes in exports. For instance, the average FEVD value in step 1 of a sanctions impulse and an exports response is 0.49 in (A01) and 0.043 in (A01a). It makes sense because of the lower number of variables included in reduced models. Hence, it seems rational to admit that the addition of five control variables increases statistical significance, and boost sanctions' ability to explain unexplained changes in exports. Consequently to the above, it is clear that trends arising from (A01) are similar to those emerging from (A01a).

TABLE III-8
IMPULSE RESPONSE FUNCTION VALUES – (A01)

<i>Model</i>	<i>Step 0</i>	<i>Step 1</i>	<i>Step 2</i>	<i>Model</i>	<i>Step 0</i>	<i>Step 1</i>	<i>Step 2</i>
1-AT	-1.8E-02	2.4E-02	-3.5E-02	15-HU	-1.4E-02	1.9E-02	-2.8E-02
2-BE	-4.7E-03	-1.1E-02	-1.5E-02	16-IE	1.8E-02	-7.7E-05	-6.6E-02
3-BG	-2.6E-02	1.6E-02	-1.7E-02	17-IT	-3.1E-04	7.5E-03	-1.2E-02
4-CY	1.6E-01	-7.3E-02	-2.2E-02	18-LT	1.6E-02	1.7E-02	-4.1E-02
5-CZ	-2.2E-02	1.5E-02	-3.9E-02	19-LU	-7.3E-02	5.1E-02	-1.3E-03
6-DE	-1.0E-02	-2.1E-03	-1.3E-02	20-LV	-1.5E-02	3.0E-02	-3.6E-02
7-DK	2.7E-03	5.8E-03	-4.9E-02	21-MT	2.1E-01	-9.5E-03	-3.7E-03
8-EE	-8.9E-03	-1.0E-02	-2.9E-02	22-NL	-4.3E-03	-2.4E-02	-1.3E-02
9-ES	-7.5E-03	-2.3E-02	-2.5E-02	23-PO	-6.1E-03	9.1E-03	-2.3E-02
10-FI	2.3E-03	-1.4E-02	-7.8E-03	24-PT	2.3E-02	-3.2E-02	-2.8E-03
11-FR	-2.5E-02	-1.6E-02	-1.5E-03	25-RO	1.3E-02	-2.2E-02	-1.5E-02
12-GB	-3.3E-02	3.4E-02	-3.4E-02	26-SE	-2.2E-02	9.8E-04	-1.5E-02
13-GR	-5.6E-02	1.6E-02	7.8E-03	27-SI	3.2E-03	1.4E-02	-3.0E-02
14-HR	-5.9E-02	6.5E-02	-5.3E-02	28-SK	-5.1E-03	-2.6E-02	-9.6E-03

Note: Response of exports after an impulse of sanctions.

TABLE III-9
MODELS RANKING BY FEVD VALUES – (A01A)

<i>Model</i>	<i>Step 1</i>	<i>Step 2</i>	<i>Model</i>	<i>Step 1</i>	<i>Step 2</i>
1-AT	0.022	0.057	15-HU	0.017	0.043
2-BE	0.003	0.013	16-IE	0.017	0.013
3-BG	0.019	0.025	17-IT	0.017	0.013
4-CY	0.123	0.076	18-LT	0.024	0.044
5-CZ	0.111	0.152	19-LU	0.125	0.150
6-DE	0.029	0.027	20-LV	0.024	0.098
7-DK	0.001	0.003	21-MT	0.043	0.041
8-EE	0.009	0.019	22-NL	0.005	0.127
9-ES	0.006	0.048	23-PO	0.002	0.007
10-FI	0.001	0.027	24-PT	0.026	0.060
11-FR	0.062	0.068	25-RO	0.008	0.024
12-GB	0.082	0.134	26-SE	0.057	0.040
13-GR	0.236	0.197	27-SI	0.000	0.008
14-HR	0.144	0.240	28-SK	0.001	0.017

Note: Response of exports after an impulse of sanctions.

2.3.2 Basic Linear Regression – (A01b)

In order to stay in line with the principle of parsimony, basic linear regressions are run, [Wooldridge \(2016\)](#). Thus, let's define the general model as:

$$XRU^i = \beta_0^i + \beta_1 SE^i + \beta_2 ML^i + \beta_3 REER^i + \beta_4 HICP^i + \beta_5 LP^i + \beta_6 PPI^i + \beta_7 ER^i + \beta_8 FI^i + \varepsilon^i \quad (15)$$

As before, European countries are ranked by alphabetical order using their country code⁹⁹, and have an attributed number ($i = 1, \dots, 28$). Variables are as described in 2.1.2 and 2.1.3, apart that XRU^i , $REER^i$, $HICP^i$, LP^i , PPI^i , ER^i and FI^i are in logarithm while SE^i and ML^i are in raw values (as they can't be turned into logarithm). On average, the R -squared (R^2) among the 28 models reaches 0.85, and 25 models have an R^2 that is above 0.73. Models 4, 13 and 21 have a relatively low R^2 , respectively 0.35, 0.48 and 0.5. The average of estimated coefficients for sanctions reaches 0.00073 (for a standard deviation equal to 0.0016), confirming that sanctions have almost no effect on exports. See Appendix III-12 for details regarding estimations.

⁹⁹ ISO 3166 Alpha-2 code.

TABLE III-10
BASIC LINEAR REGRESSION, KEY VALUES – (A01B)

<i>Model</i>	<i>R2</i>	<i>y1 coef</i>	<i>Model</i>	<i>R2</i>	<i>y1 coef</i>
1	0.93260	0.00088	15	0.9193	0.0007979
2	0.95050	-0.00061	16	0.7946	0.0001747
3	0.91910	0.00053	17	0.9723	0.0001636
4	0.34780	0.00233	18	0.9671	0.0002882
5	0.98930	-0.00003	19	0.7296	0.000035
6	0.94380	-0.00004	20	0.9791	0.0001274
7	0.87380	0.00016	21	0.5045	0.0083468
8	0.92340	0.00089	22	0.8864	-0.0002589
9	0.96360	0.00016	23	0.9571	0.0003283
10	0.88630	0.00051	24	0.8327	0.0004842
11	0.88040	0.00007	25	0.9771	0.0008436
12	0.82590	0.00082	26	0.8333	0.0004716
13	0.48430	0.00017	27	0.9086	0.0007036
14	0.76200	0.00117	28	0.9508	0.0009297

2.3.3 Bayesian Linear Regression – (A01c)

Basic linear regressions ran in 2.3.2 follow a *frequentist approach* since model parameters are treated as having fixed but unknown values. The *Bayesian approach* sees statistics in a different way since it is assumed that model parameters are random variables described with a probability distribution. See [Box and Tiao \(2011\)](#) for further details about Bayesian linear regression. Coefficients obtained within this method follow a probabilistic interpretation, which is quite different from basic linear regressions. In our case, parameters are estimated using Markov chain Monte Carlo (MCMC), see [Gamerman and Lopes \(2006\)](#). As described in STATA manual, while basic linear regression produces only one estimate, Bayesian regression produces 10 000 MCMC estimates. These estimates are simulated from a posterior distribution of model's parameters, and the default sampling algorithm used is an adaptive Metropolis-Hastings algorithm. The fact that the prior probability distribution is obtained before the observation of any data is a real change from basic linear regression. It is thus interesting to use the *Bayesian approach* as an additional robustness test. Data used are identical to 2.3.2. Results are in line with previous models. The average value of sanction coefficients within the 28 models is 0.000074. Moreover, all these

coefficients fall within the 95% confidence range, see Appendix III-13 for details regarding estimations.

TABLE III-11
BAYESIAN LINEAR REGRESSION, KEY VALUES – (A01C)

<i>Model</i>	<i>y1 coef</i>	<i>Model</i>	<i>y1 coef</i>
1	0.000924	15	0.0003298
2	-0.0006454	16	-0.0004706
3	-0.0000657	17	0.0000111
4	0.0004589	18	-0.0001705
5	-0.0002904	19	-0.000821
6	-0.0003291	20	-0.0003272
7	-0.0001506	21	0.0034137
8	0.0002689	22	-0.000634
9	-0.0000997	23	-0.0000351
10	0.0001404	24	-0.0000819
11	-0.000373	25	0.0004111
12	0.0002152	26	-0.0000742
13	-0.0007157	27	0.0003521
14	0.0004289	28	0.0003989

3. Trade and Sanctions: Russia - (A02)

Sanctions of the European Union are far from being an embargo against Russia. Indeed, there is no restriction affecting Russian exports to the EU. Yet, they decreased by -219.16b€ between periods. Thus, the question raised is whether Russian exports to the EU were impacted by sanctions, even if they were not targeted by them.

3.1 Architecture

The objective is to check if there is a *sanction ripple effect* regarding total exports of Russia to the EU. For the sake of consistency, it has been decided to build a nine variables SVAR model. The study period starts in 2003q1 and ends in 2019q4. Its frequency is quarterly and thus gathers 67 observations¹⁰⁰.

3.1.1 Framework

$$y_t^* = (SE_t \ ML_t' \ OIL_t \ GAS_t \ CPI_t \ PPI_t' \ ER_t \ FI_t' \ XEU_t) \quad (16)$$

¹⁰⁰ As for (A01), there are 68 observations from 2003q1 to 2019q4, but the first one (2003q1) is a missing value, since our series are growth rates.

There are four domestic variables and five external variables. Marginal lending key interest rate of the Russian Central Bank (ML'_t), consumer price index for Russia (CPI_t), producer price index in industry for Russia (PPI'_t) and Russia's exports to the EU (XEU_t) are domestic variables (specific to Russia). The sanction index (SE_t), Brent oil price (OIL_t), natural gas price (GAS_t), country's currency exchange rate against the Russian rouble (ER_t), and foreign income (FI'_t) are external variables. Russia's exports to the EU is ordered last and is thus the variable to be explained. The sanction index is ordered first and is the causal variable. The particularity of this framework is that two external variables are country-specific: exchange rate against the Russian rouble and foreign income. For instance, a model that is integrating Russia's exports to Spain has to use euro against Russian rouble and Spain's GDP, while a model integrating Russia's exports to Sweden will use Swedish krona against Russian rouble and Sweden's GDP. It is thus necessary to run 28 models (for each country of the EU), ordered in a similar fashion as Table III-2. Equation (16) can be rewritten (for $i = 1, \dots, 28$) as:

$$y_{t,i}^* = (SE_t \ ML'_t \ OIL_t \ GAS_t \ CPI_t \ PPI'_t \ ER_{t,i} \ FI'_{t,i} \ XEU_{t,i}) \quad (17)$$

3.1.2 Choice of Variables

Most variables were chosen for the same reasons as those detailed in 2.1.2. It is possible since subsections (A01) and (A02) run models that have a similar explanatory variable. Nevertheless, the framework of this subsection slightly changes since determinants of Russian exports subtly differ from those of European exports. Consequently, Brent oil price and natural gas price are used as replacement for labour productivity and real effective exchange rate. This is due to a very simple fact: if European exports to Russia are mainly composed of machinery and transport equipment (see Graph I-3), almost three-quarters¹⁰¹ of Russia's exports to the EU were crude materials.

¹⁰¹ 70.58% to be precise, between 2003 and 2019, in average. Data source: Eurostat [DS-018995].

3.1.3 Data Treatments

Contrarily to subsection (A01), fewer adjustments have been done to databases of this subsection, see Table III-12. Moreover, variables $ER_{t,i}$ and SE_t are exactly as described in 1.1.2.

TABLE III-12
DATA SOURCE – (A02)

<i>Variable</i>	<i>Details</i>
XEU_t	Russia's Exports to the EU – Eurostat ; extracted on 22.07.20; last update 16.07.20; total imports of EU countries; partner: Russian Federation; (SITC 891); value in euros; monthly data turned into quarterly; EU trade since 1988 by SITC [DS-018995].
OIL_t	Brent Oil Price – Federal Reserve Bank of St. Louis ; Crude Oil Prices: Brent – Europe; Dollars per Barrel; Not Seasonally Adjusted. Initially in monthly values, turned into quarterly.
$PPI'_{t,i}$	Producer Prices in Industry – Federal Reserve Bank of St. Louis ; Producer Prices Index: Economic Activities: Domestic Industrial Activities for the Russian Federation; Index 2015=100; Quarterly; Not Seasonally Adjusted.
GAS_t	Natural Gas Price – Federal Reserve Bank of St. Louis ; Global price of Natural gas; area: EU; U.S. Dollars per Million Metric British Thermal Unit; Quarterly; Not Seasonally Adjusted.
$FI'_{t,i}$	Foreign Income – Eurostat ; extracted on 23.07.20; gross domestic product at market prices and main components (output, expenditure and income); seasonally and calendar adjusted data, except for Slovakia that is not calendar adjusted; [namq_10_gdp].
CPI_t	Consumer Price Index of Russia – Federal Reserve Bank of St. Louis ; Consumer Price Index: All Items for Russian Federation, Index 2015=100, Quarterly, Not Seasonally Adjusted.
$ML_{t,i}$	CBR Marginal Lending Facility – Federal Reserve Bank of St. Louis ; immediate rates: less than 24 hours: Central Bank rates for the Russian Federation; percent; quarterly; not seasonally adjusted.

3.1.4 Stationarity & Lag Order

As most series aren't $I(0)$, they are all¹⁰² turned into logarithm and then first-differenced, which means that they are all growth rate. Eighteen series successfully pass Clemente–Montañés–Reyes stationarity test, while thirty-two fail, but pass DF-GLS test. Series left all succeed¹⁰³ in rejecting H_0 within the classical ADF test. Consequently, all series are stationary.

¹⁰² Sanctions are directly turned into growth rate.

¹⁰³ Spain's GDP growth rate fails to pass ADF test for a 5% critical value, but succeed for a 1% critical value.

3.2 Results

Judging by impulse response functions' confidence intervals, all IRF ran are statistically significant. Models 1, 2, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, 20, 22, 25, 26, react negatively when the sanction shock happens. It lasts a quarter for models 1, 2, 11, 12, 14, and 25. This negative effects remains for an additional quarter within models 1 and 12. Nevertheless, as in subsection (A01), the values of these shocks are really close to zero. Hence, the mean among all models for step 0 is -5.89E-15, 6.19E-15 in step 1, and 4.03E-14 in step 2. It thus seems coherent to admit that sanctions don't have direct effects on Russia's exports to the European Union, see Appendix III-14 for graphs and Appendix III-14b for values. Regarding forecast error variance decomposition, six models are above 80%, six others are between 80% and 50%, five are between 30% and 10%, and eleven are under 10%. Consequently and in comparison with (A01), it seems that sanctions are slightly less likely to explain unexplained changes in exports.

TABLE III-14
IMPULSE RESPONSE FUNCTION VALUES – (A02)

<i>Model</i>	<i>Step 0</i>	<i>Step 1</i>	<i>Step 2</i>	<i>Model</i>	<i>Step 0</i>	<i>Step 1</i>	<i>Step 2</i>
1-AT	-1.8E-16	-6.7E-16	-2.9E-15	15-HU	-7.4E-15	3.5E-15	3E-16
2-BE	-4.3E-13	-1.1E-14	3.5E-13	16-IE	-1.8E-14	2.6E-14	1.2E-14
3-BG	2.6E-15	-1E-14	-5.1E-15	17-IT	-1.8E-14	2.6E-14	1.2E-14
4-CY	1.1E-15	2.6E-15	-8.5E-15	18-LT	8.4E-15	-6.2E-15	-1.4E-15
5-CZ	1.3E-14	-2.7E-14	1.6E-14	19-LU	2.9E-13	1.2E-13	8.1E-13
6-DE	-1.3E-16	4.4E-16	-4.7E-16	20-LV	-3.4E-14	8.3E-14	-8.9E-14
7-DK	5.2E-16	1.5E-15	-6.3E-16	21-MT	2.6E-14	-1.1E-14	-1.7E-15
8-EE	-1.5E-15	2.9E-15	2.4E-14	22-NL	-7.3E-15	1.2E-15	-1.3E-14
9-ES	4.5E-16	-2.2E-15	3.9E-15	23-PO	1.2E-15	3E-15	2.2E-15
10-FI	-1.1E-15	5.4E-16	-3.6E-15	24-PT	1.6E-14	-2E-14	1.2E-16
11-FR	-8.4E-15	-7E-15	1.7E-14	25-RO	-2.4E-15	-5E-15	1.2E-14
12-GB	-8.2E-17	-1.7E-15	-1.4E-15	26-SE	-4.8E-16	2.8E-15	-1.9E-15
13-GR	-8E-16	5.9E-15	-3.9E-15	27-SI	1E-15	-4.2E-15	-1.6E-14
14-HR	-1.2E-15	-3.6E-15	1.6E-15	28-SK	5.8E-15	3.4E-15	1.7E-14

Note: Response of Russia's exports after an impulse of sanctions.

TABLE III-15
MODELS RANKING BY FEVD VALUES – (A02)

<i>Model</i>	<i>Step 1</i>	<i>Step 2</i>	<i>Model</i>	<i>Step 1</i>	<i>Step 2</i>
2-BE	0.999971	0.99871	28-SK	0.158656	0.052063
20-LV	0.983991	0.982493	25-RO	0.150029	0.232729
19-LU	0.954916	0.946732	7-DK	0.119197	0.189864
5-CZ	0.911972	0.953873	10-FI	0.081385	0.047331

15-HU	0.884745	0.72964	14-HR	0.059296	0.110205
24-PT	0.813721	0.788879	4-CY	0.055431	0.078878
22-NL	0.705574	0.654668	8-EE	0.044643	0.053753
21-MT	0.687468	0.469918	9-ES	0.02979	0.248004
16-IE	0.685447	0.619971	26-SE	0.011909	0.186931
17-IT	0.685447	0.619971	6-DE	0.009685	0.026484
18-LT	0.681593	0.363809	27-SI	0.00909	0.052021
11-FR	0.572945	0.535294	3-BG	0.008883	0.106998
23-PO	0.320496	0.382285	12-GB	0.002597	0.123891
13-GR	0.221369	0.114694	1-AT	0.001935	0.017468

Note: Response of Russia's exports after an impulse of sanctions.

3.3 Robustness Check

As for subsection (A01), it is necessary to check the robustness of our results. The adopted drill remains, which is the use of reduced CSVAR models, basic linear regressions, and Bayesian linear regression.

3.3.1 Reduced CSVAR Models – (A02a)

Similarly to 2.3.1, let's run four variables CSVAR models instead of nine. The framework is identical to what was done in (A02). Thus, $y_t^{*'}$ is the vector of endogenous variables for $t = 1, \dots, 67$:

$$y_t^{*'} = (SE_t \ ML_t \ OIL_t \ XRU_t) \quad (18)$$

As models that will be run are reduced forms of models ran in (A02), variables and data are similar. Thus, the sanction index (SE_t) is used, followed by marginal lending rate (ML_t), brent oil price (OIL_t), and Russia's exports to the EU (XRU_t). As before, each country of the EU has its own model, which means that 28 models are run in total. Consequently, equation (18) becomes (for $i = 1, \dots, 28$):

$$y_{t,i}^{*'} = (SE_t \ ML_t \ OIL_t \ XRU_{t,i}) \quad (19)$$

Because the used database is identical to the one in (A02), stationarity and data treatments are identical to what is described in 3.1.3 and 3.1.4. Nonetheless, the lag order is different from (A02) since models are reduced CSVAR based on (19). It has been decided here to use Akaike's Information criterion (AIC) for two reasons. Firstly, eighteen models have a lag equal to 8 if AIC is used. Secondly, models

using a lag associated to AIC result have a greater statistical significance (see Annexes, [Graph III-2](#)). Results confirm previous findings, since IRFs values after a sanction shock are in average equal to -0.002 in step 0, -0.007 in step 1 and -0.019 in step 2. FEVD values decrease drastically, which can be explained by the loss of control variables. Thus, 26 models have an FEVD in step 1 under 10%.

3.3.2 Basic Linear Regression – (A02b)

Similarly to 2.3.2, basic linear regressions are run as robustness test. The general model is defined as (*for* $i = 1, \dots, 28$):

$$XEU^i = \beta_0^i + \beta_1 SE + \beta_2 ML + \beta_3 OIL + \beta_4 GAS + \beta_5 CPI + \beta_6 PPI + \beta_7^i ER^i + \beta_8^i FI^i + \varepsilon^i \quad (20)$$

Variables remain as in 3.1.2 and 3.1.3, and the only difference is that sanctions and key interest rate are run as raw values, while others are run as logarithm; sanctions and key interest rate can't be turned into logarithm because of the high number of zeros. The mean of the coefficient of determination among models is equal to 0.75 and twenty models are above or equal to 0.7. Regarding the other eight, five models are above 0.56, and the other three are equal to 0.43, 0.4, and 0.2 (which is quite low). If one excludes these three, the average is 0.8, which is satisfactory for a robustness test. Models' results are in line with findings obtained through our 9 variables CSVAR models. Indeed, in average the estimated coefficient for sanctions (among the 28 models) reaches the value of 0.00013, confirming that European sanctions have no effects on Russia's exports to countries of the EU. See Appendix III-15 for details regarding estimations.

TABLE III-17
BASIC LINEAR REGRESSION, KEY VALUES – (A02B)

<i>Model</i>	<i>R2</i>	<i>y1 coef</i>	<i>Model</i>	<i>R2</i>	<i>y1 coef</i>
1	0.6960	-0.0008	15	0.8684	-0.0003
2	0.8843	0.0011	16	0.7632	-0.0011
3	0.6717	-0.0003	17	0.8713	0.0002
4	0.3974	-0.0024	18	0.8767	-0.0003
5	0.8564	0.0004	19	0.6155	0.0024
6	0.9416	-0.0001	20	0.7903	-0.0001
7	0.7783	0.0005	21	0.5620	0.0046
8	0.5816	-0.0002	22	0.9203	0.0000
9	0.8414	0.0005	23	0.9632	0.0000

10	0.8937	-0.0005	24	0.4324	-0.0011
11	0.8133	-0.0005	25	0.6978	0.0006
12	0.6335	0.0002	26	0.8769	0.0005
13	0.7845	-0.0008	27	0.2049	-0.0003
14	0.8391	0.0012	28	0.8752	0.0001

3.3.3 Bayesian Linear Regression – (A02c)

As in 2.3.3, Bayesian linear regressions are now run in order to step out from the *frequentist approach*. Here again, estimations are obtained with MCMC, through a sample size equal to 10 000. Data used are identical to 3.3.3. Results are once again in line with previous findings. Indeed, the average value of sanction coefficients is 0.00011; all coefficients fall within the 95% confidence interval, see Appendix III-16 for further details.

TABLE III-18
BAYESIAN LINEAR REGRESSION, KEY VALUES – (A02C)

<i>Model</i>	<i>y1 coef</i>	<i>Model</i>	<i>y1 coef</i>
1	-0.0007	15	-0.0003
2	0.0011	16	-0.0011
3	-0.0004	17	0.0002
4	-0.0024	18	-0.0003
5	0.0004	19	0.0026
6	-0.0001	20	-0.0002
7	0.0005	21	0.0044
8	-0.0002	22	0.0000
9	0.0006	23	0.0001
10	-0.0005	24	-0.0012
11	-0.0005	25	0.0006
12	0.0003	26	0.0004
13	-0.0007	27	-0.0004
14	0.0009	28	0.0001

4. Economic Growth and Sanctions - (A03)

Trade was examined in previous subsections, and even if it is a matter of great interest, this thesis' analysis would be incomplete if it had to stop here. Indeed, it also seems essential to capture the overall impact of coercive measures on considered economies. To do so, it has been decided to run CSVAR models that use growth domestic product as variable of interest. Consequently, it will be possible

to check whether sanctions are able to create consequent and significant economic disruptions on economies' total output of goods and services.

4.1 Architecture

This subsection is once again an attempt to detect a *sanction ripple effect*. Indeed, since sanctions target only a small share of final goods and services produced within considered economies, consequent and statistically significant changes on examined GDP –after a sanction shock– could clearly be seen as the outcome of *sanctions ripple effect*. The study period starts in 2003q1 and ends in 2019q4. Data's frequency is quarterly and gathers 67 observations.

4.1.1 Framework

Let's define y_t^{**} (for $t = 1, \dots, 67$) a vector of endogenous variables as follows:

$$y_t^{**} = (SE_t \ ML_t \ FDI_t \ REER_t \ HICP_t \ LP_t \ GS_t \ GX_t \ GDP_t) \quad (21)$$

It integrates eight domestic variables (country-specific) and one external variable. Marginal lending key interest rate (ML_t), foreign direct investment (FDI_t), real effective exchange rate ($REER_t$), harmonised index of consumer prices ($HICP_t$), labour productivity (LP_t), gross savings (GS_t), government expenditure (GX_t), and gross domestic product (GDP_t) are domestic variables. The sanction index (SE_t) is an external variable. GDP is ordered last as it is the variable of interest; the sanction index is still ordered first as it is the causal variable; variables in-between are control variables. All models of this subsection follow this vector of endogenous variables. The exact number of models remains 28, and equation (21) becomes:

$$y_{t,i}^{**} = (SE_t \ ML_{t,i} \ FDI_{t,i} \ REER_{t,i} \ HICP_{t,i} \ LP_{t,i} \ GS_{t,i} \ GX_{t,i} \ GDP_{t,i}) \quad (22)$$

As before, European countries are ranked by alphabetical order using their country code¹⁰⁴ and their attributed number ($i = 1, \dots, 28$) remains as in previous subsections.

¹⁰⁴ ISO 3166 Alpha-2 code.

4.1.2 Choice of Variables

Economic growth is a well-known and explored study subject of the theoretical economic literature. [Smith \(1776\)](#) in *The Wealth of Nations* was putting forward three main production factors: land, labour, and capital. Later, [Ricardo \(1817\)](#) will develop Smith's theory and keep only capital and labour. In this classical framework, technological progress is held constant and economies of scale are ignored. This is fixed within the Neoclassical model, mostly known as the Solow-Swan model, from [Solow \(1956\)](#) and [Swan \(1956\)](#). Indeed, within this model, economic production –and thus growth– depends on capital, labour, and technology (as an exogenous factor). The endogenous growth theory comes later, introduced by [Lucas Jr \(1988\)](#) and [Romer \(1986\)](#). Their model implies that growth determinants are endogenous and not exogenous, particularly the technological factor. The state, through public policies, is playing a key role in the diffusion of the use of technology. Moreover, they also highlight that human capital (i.e. skilled workers, meaning that education matters) and intellectual property are taking part in economic growth. Public spending is clearly brought forward by [Keynes \(1936\)](#) and his *multiplier effect*. He states that an initial public investment will lead to more than proportional positive outcomes to the economy. Public spending is also studied as determinant of growth by [Barro \(1991\)](#), followed later by [Barro and Sala-i-Martin \(1992\)](#). Nevertheless, it is important to remind that the Austrian school (L.H.E. Mises, F.A. Hayek, *etc.*) was seriously and robustly opposed to Keynesianism and its outcomes.

However, the aim of this research is not to make a stand regarding the different schools of economic thought. Hence, the variable selection process within the CSVAR methodology has as main goals to: (i) select coherent control variables; (ii) use data that are as much similar as possible in order to obtain uniformity within our models. Thus, variables have once again been selected on both theoretical and empirical evidence. From an empiric perspective, [Delgado *et al.* \(2014\)](#) can't find significant effect of education on economic growth. Moreover, it is hard to find a coherent proxy for education that is stationary and available for the 28 European economies. Thus, education was not integrated as control variable of economic

growth. Several variables already used in subsection (A01) are used again. For instance, $HICP_{t,i}$, $LP_{t,i}$, $ML_{t,i}$ and $REER_{t,i}$ are integrated as control variables. It makes sense because by affecting exports, these variables affect trade balance and thus economic growth.

- **Marginal lending key interest rate (ML_t):** As stated earlier, key interest rates can influence exports through the monetary transmission mechanism [Christiano and Eichenbaum \(1992\)](#). Consequently, trade balance and thus economic growth can be affected by changes in key interest rate. Moreover, the empiric relationship between key interest rate and economic growth appears in many papers. [Dotsey \(1998\)](#) reveal that the interest rate spread is useful to forecast economic activity, [Odhiambo \(2009\)](#) demonstrate the dynamic impact of interest rate reforms on economic growth, and many others integrate key interest rate as control variable, see [Obansa et al. \(2013\)](#), [Demetriades and Luintel \(1996\)](#), [Berthelemy and Varoudakis \(1996\)](#), *et cetera*.
- **Foreign direct investment (FDI_t):** A consequent work has been accomplished regarding effects of FDI on growth. [Borensztein et al. \(1998\)](#) supports the influence of FDI on economic growth, arguing that FDI contribute even more to growth than domestic investment. [Carkovic and Levine \(2005\)](#) state that from a microeconomic perspective, FDI do not influence economic growth, while they do from a macroeconomic point of view. [Choe \(2003\)](#) found that FDI Granger causes economic growth and *vice versa*, using a panel VAR model. [Li and Liu \(2005\)](#) state that FDI indirectly promote economic growth. Finally, [Próchniak \(2011\)](#) state that FDI are an important determinant of economic growth, and this is demonstrated in many other papers, see [Borys et al. \(2008\)](#), [Zhang \(2001\)](#), [Adams \(2009\)](#), *etc*.
- **Real effective exchange rate ($REER_t$):** Evidence of the relationship between exchange rate and economic growth appears in many research papers. For instance, [Rodrik \(2008\)](#) shows that undervaluation of the currency stimulates economic growth and [Rapetti et al. \(2012\)](#) extend this work. [Eichengreen \(2007\)](#) also focus on the role of the real exchange rate in the growth process. More recently, [Missio et al. \(2015\)](#) empirically analyse

the relationship between real exchange rate (RER) and growth rate, and conclude that maintaining a competitive level of RER has positive effects on growth rate. Even more recently, [Habib et al. \(2017\)](#) use external instruments to study this topic and confirm the relationship.

- **Harmonised index of consumer prices ($HICP_t$):** The link between inflation and economic growth is also a classic field of study in economics. [Barro \(1995\)](#) demonstrated this relationship using data for around 100 countries from 1960 to 1990. A year later, [Sarel \(1996\)](#) focuses on nonlinear effects of inflation on economic growth and also support the connection between inflation and growth. Similarly, this relationship appears in [Mallik and Chowdhury \(2001\)](#), [De Gregorio \(1992\)](#), [Andrés and Hernando \(1999\)](#), [Gokal and Hanif \(2004\)](#), and so on.
- **Labour productivity (LP_t):** Labour productivity directly affects economic growth since it defines “how good” a defined production is achieved. It affects how many products will be produced, but it also defines the overall amount of labour required within an economy. To be precise, the very intuitive relationship between labour productivity and growth appears in many papers as [Auzina-Emsina \(2014\)](#), [Timmer et al. \(2011\)](#), [Rudolf and Zurlinden \(2010\)](#), [Gerdin \(2002\)](#), [Korkmaz et al. \(2017\)](#), [Van der Eng and others \(2009\)](#), *et cetera*. It thus seems coherent to include labour productivity among our models’ control variables.
- **Government expenditure (GX_t):** As explained earlier, public spending and economic growth are also a classic field of study within the economic literature. Keynesianism and related school of economic thought have highlighted this relationship. From an empirical perspective, many papers studied this matter, such as [Landau \(1983\)](#), [Nurudeen and Usman \(2010\)](#), [Irmen and Kuehnel \(2009\)](#), [Loto \(2011\)](#), [Kolluri et al. \(2000\)](#), [Wu et al. \(2010\)](#), [Arpaia and Turrini \(2007\)](#), *et cetera*.
- **Gross savings (GS_t):** Similarly to public spending, some authors such as F.A. Hayek argue that an increase in savings can lead the economy to a profitable and higher equilibrium between supply and demand, see [Hayek \(1931\)](#). The empirical demonstration of this relationship appears in the

literature, see [Anoruo and Ahmad \(2001\)](#), [AbuAl-Foul \(2010\)](#), [Misztal \(2011\)](#), [Apilado \(1972\)](#), [Lean and Song \(2009\)](#), *et cetera*.

4.1.3 Data Treatments

As before, data have been subjected to adjustments and treatments, so it is thus important to describe what has been done. Data's origin is available in Table III-19.

TABLE III-19
DATA SOURCE – (A03)

<i>Variable</i>	<i>Details</i>
$GDP_{t,i}$	Growth Domestic Product – Eurostat ; extracted on 23.07.20; gross domestic product at market prices and main components (output, expenditure and income); seasonally and calendar adjusted data, except for Slovakia that is not calendar adjusted; [namq_10_gdp].
$LP_{t,i}$	Labour Productivity (per hours worked) – European Central Bank ; total economy; all activities; index; chain linked volume (rebased); non-transformed data; neither seasonally adjusted nor calendar adjusted data; average of observations through period (A).
$GS_{t,i}$	Gross Saving of Total Economy – European Central Bank ; most data are “Gross saving of Total economy” from the European Central Bank, calendar and seasonally adjusted, but some countries had too many missing values. Thus, data for Hungary and Malta are “Gross savings (current US\$)” from World Bank national accounts data, and OECD National Accounts data files. Data for Italy are “Gross household saving rate” from Eurostat, neither seasonally adjusted nor calendar adjusted, in percentage.
$REER_{t,i}$	Real Effective Exchange Rate – Eurostat ; extracted on 04.06.20; last update 03.06.20; deflator: consumer price index - 42 trading partners - industrial countries; Index, 2010=100; [ert_eff_ic_q].
$GX_{t,i}$	Total Government Expenditure – European Central Bank ; Debit (Uses); counterpart area: World (all entities, including reference area, including IO), counterpart sector: Total economy; partially consolidated or aggregate containing both consolidated and non-consolidated items; current prices; standard valuation based on SNA/ESA; domestic currency (incl. conversion to current currency made using a fixed parity); calendar and seasonally adjusted data - ESA 2010. Data for Cyprus, Spain, Greece, Croatia, Ireland, and Italy are from the same database, but neither seasonally adjusted nor calendar adjusted - ESA 2010.
$FDI_{t,i}$	Foreign Direct Investment – European Central Bank ; Country vis-a-vis Rest of the World - Total economy – Transactions - Net Acquisition of Assets - Direct Investment; total financial assets/liabilities, Euro-All currencies; compilation methodology based on international standards; quarterly; neither seasonally adjusted nor calendar adjusted data. Data for Cyprus, Denmark, Finland, Malta and Poland had too many missing values. Consequently, their data come from : Foreign direct investment – International Monetary Fund, Balance of Payments database, supplemented by data from the United Nations Conference on Trade and Development and official national sources; net inflows (BoP, current US\$).

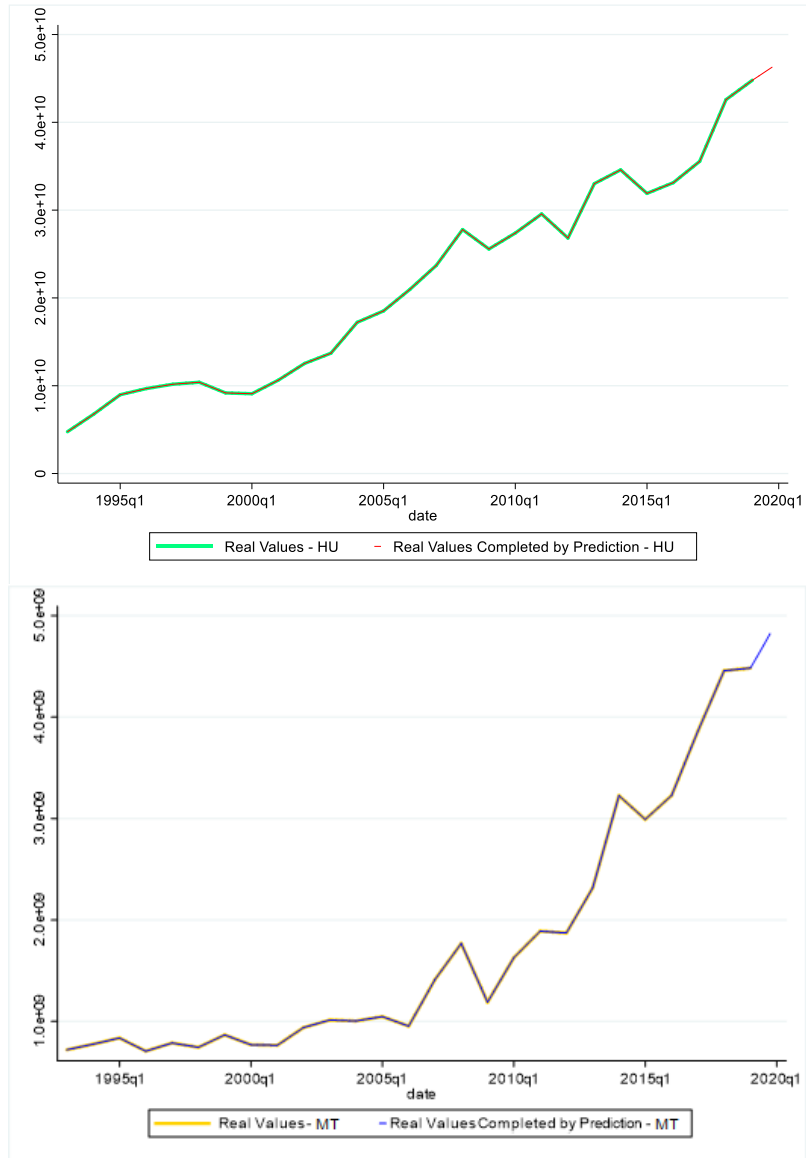
$HICP_{t,i}$	Harmonised Index of Consumer Prices – Eurostat ; extracted on 04.06.20; last update 29.05.20; index, 2015=100; neither seasonally adjusted nor calendar adjusted data; all items; monthly data [ei_cphi_m].
$ML_{t,i}$	ECB Marginal lending facility – European Central Bank ; euro area (changing composition); key interest rate; date of changes (raw data); level; euro; average of observations through period; percent per annum.
$SE_{t,i}$	Sanction Index (European Sanctions) – Bali et al. (2020) ; the index construction is detailed in Chapter II; index values available in Annexes, Table II-s .

The high number of missing values within databases could not have been ignored, and it was important to rigorously deal with them; several possibilities and choices had to be made. This task became even daunting and arduous since this research integrates a large number of countries. Moreover, as data homogeneity between these countries is an important condition for the run of CSVAR models, a major priority was to obtain data from a source where all countries were available. Consequently, Eurostat and the European Central Bank Data Warehouse were a legitimate choice. Datasets able to provide great data for a large majority of countries were always kept, in order to ensure homogeneity for most CSVAR run. Nonetheless, it has been necessary to find different data sources for countries that had a large number of missing values. For instance, in the case of Foreign Direct Investment, data for¹⁰⁵ Cyprus, Denmark, Finland, Malta and Poland come from a different database, and are in yearly frequency¹⁰⁶. They were converted in euro and then turned into quarterly data with Eviews 10 (match first). Their last three quarters had to be forecasted, and it was done by comparing the regression that had the highest R^2 (exponential trend regression for instance). Predicted values and original values were often different (bigger or lower), but their trends were similar. Thus, to avoid creating break point in series by implementing values which were not in line with the historical trend, gross rates of predicted values were used (see Appendix III-17). Even if R^2 values were low in some cases, predicted values were always in line with historical trend, see Graph III-3. A similar method was used for Gross Savings of Total Economy, for Hungary, Luxembourg and Malta (see Appendix III-18). Finally, $HICP_{t,i}$, $LP_{t,i}$, $ML_{t,i}$, $SE_{t,i}$, and $REER_{t,i}$ are as described in 2.1.3, while $GDP_{t,i}$ is as described in 3.1.3 (under the name: “foreign income”).

¹⁰⁵ Data for Netherlands and Slovakia came from the main database used for FDI, but also have some predicted values.

¹⁰⁶ Regarding the frequency conversion method, different possibilities have been compared, and the best option was adopted (see Appendix, III-27).

**GRAPH III-3
PREDICTED VALUES VS HISTORICAL TREND**



4.1.4 Stationarity

All series used in our models are stationary I(1). Details regarding $HICP_{t,i}$, $LP_{t,i}$, $ML_{t,i}$, $SE_{t,i}$, and $REER_{t,i}$ are as described in 2.1.4, while $GDP_{t,i}$ is as in 3.1.4 (under the name: “foreign income”). Among other series, eighty-four pass Clemente-Montanes-Reyes test while fifty fail it. Among these fifty, forty-nine succeed to reject the null hypothesis in DF-GLS test, and one fails. This series however passes ADF test without issues. Results are available in Appendix III-19. Since most series are not stationary at level, it was necessary to turn them into growth rate (either after first being transformed into logarithm, or by using the variation rate formula for series that have many zeros).

4.1.5 Lag order

As before, let’s remind that HQIC and SBIC have a similar interpretation as AIC. However, if these tests provide a different lag number, the one leading to the most statistically significant orthogonalized IRF is kept (see Appendix III-20).

4.2 Results

As before, this section gathers results of orthogonalized impulse response function and forecast error variance decomposition. Interpretation of these results will be achieved in this chapter’s conclusion.

4.2.1 Impulse Response Function

Results from models’ IRF are statistically significant. Models 1, 3, 4, 7, 9, 14, 15, 16, 17, 20, and 23 react negatively when the sanction shock happens. This negative effect lasts one additional quarter in models 1, 3, 9, 15, 16, 17, and 23. This shock lasts six months for models 1, 15, and 23. As for previous models, there are many zeros behind the decimal point, and it thus seems rational to admit that sanctions effects on countries’ GDP is nil (the average IRF value in step 0 is 5.54E-16, 3.83E-16 in step 1, and 4.84E-15 in step 2). See Appendix III-21 for IRF graphs and Appendix III-21b for IRF detailed values.

TABLE III-21
IMPULSE RESPONSE FUNCTION VALUES – (A03)

<i>Model</i>	<i>Step 0</i>	<i>Step 1</i>	<i>Step 2</i>	<i>Model</i>	<i>Step 0</i>	<i>Step 1</i>	<i>Step 2</i>
1-AT	-6.3E-16	-1.8E-15	-8.3E-16	15-HU	-1.1E-15	-2.2E-16	-5.8E-16
2-BE	9.6E-16	6.4E-16	-1.1E-15	16-IE	-1.9E-15	-3.4E-15	2.1E-15
3-BG	-1.4E-15	-1.5E-15	9.1E-17	17-IT	-1.9E-15	-3.4E-15	2.1E-15
4-CY	-1.6E-16	4.1E-16	-1.5E-16	18-LT	5.8E-15	-7.3E-15	-3.6E-16
5-CZ	1.7E-16	2.4E-17	-5.2E-16	19-LU	1.3E-15	-3.9E-15	9.4E-15
6-DE	4.7E-16	8.5E-16	7E-17	20-LV	-1E-16	2E-16	-2.8E-17
7-DK	-5.9E-16	1.7E-16	-1E-15	21-MT	2.7E-15	-1.9E-15	-4E-15
8-EE	4.6E-16	7.3E-16	2.1E-15	22-NL	2.3E-16	1.1E-15	1.4E-15
9-ES	-2.1E-15	-3.5E-15	2.3E-15	23-PO	-1.4E-14	-8.1E-15	-7.3E-15
10-FI	1.2E-15	-1.6E-16	1.9E-16	24-PT	1E-16	7.4E-17	3.3E-16
11-FR	2.8E-16	-2.1E-16	5.3E-16	25-RO	3.2E-16	4.4E-17	-9.8E-16
12-GB	2.1E-16	-3E-16	3.4E-16	26-SE	4E-17	2.3E-16	1.5E-16
13-GR	1E-15	1.8E-15	1.5E-15	27-SI	2.1E-14	4.3E-14	1.3E-13
14-HR	-2.6E-16	3.5E-16	-4.5E-16	28-SK	3.4E-15	-3.2E-15	1.8E-16

Note: Response of Russia's exports after an impulse of sanctions.

4.2.2 FEVD

Models' FEVD are above or equal to 80% for 8 models, between 80% and 50% for 7 models, between 50% and 10% for nine others, and the last 5 models are under 10%. Consequently, in 15 models, a similar sanction shock can explain at least 50% of the unexplained variations of GDP quarter-on-quarter growth. In average, the FEVD values among our 28 models reaches 49.99% in step I and 49.59% in step II. Half our models have a FEVD value above 49.24%. See Table III-22 for further details and Appendix III-21c for full results.

TABLE III-22
MODELS RANKING BY FEVD VALUES – (A03)

<i>Model</i>	<i>Step 1</i>	<i>Step 2</i>	<i>Model</i>	<i>Step 1</i>	<i>Step 2</i>
28-SK	0.971634	0.934164	7-DK	0.461049	0.314943
23-PO	0.948512	0.719	16-IE	0.358387	0.687151
27-SI	0.943477	0.862223	17-IT	0.358387	0.687151
1-AT	0.920835	0.792651	24-PT	0.355971	0.187254
5-CZ	0.897408	0.637658	19-LU	0.312694	0.680151
11-FR	0.855791	0.736157	6-DE	0.299682	0.356666
9-ES	0.840484	0.755219	15-HU	0.274037	0.054123
3-BG	0.795767	0.846716	8-EE	0.256839	0.340714
21-MT	0.723337	0.621821	13-GR	0.165477	0.393037
2-BE	0.68536	0.437459	20-LV	0.090238	0.162965
10-FI	0.667221	0.560831	14-HR	0.07001	0.066168
25-RO	0.571048	0.459481	12-GB	0.054091	0.043442
22-NL	0.543007	0.591097	4-CY	0.03276	0.181889

18-LT	0.523713	0.481029	26-SE	0.019684	0.294057
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Note: Response of Russia's exports after an impulse of sanctions.

4.3 Robustness Check

As for previous subsections, it is necessary to check the robustness of our results. To that extent and as before, reduced CSVAR models, basic linear regressions, and Bayesian linear regression are used.

4.3.1 Reduced CSVAR Models – (A03a)

Similarly to 3.3.1, let's run four variables CSVAR models. The framework is identical to (A03). Thus, $y_t^{**'}$ is the vector of endogenous variables for $t = 1, \dots, 67$:

$$y_t^{**'} = (SE_t \ ML_t \ GX_t \ GDP_t) \quad (23)$$

As models run here are reduced forms of models run in (A03), variables and data are similar. Thus, the sanction index (SE_t) is used, followed by marginal lending rate (ML_t), government expenditures (GX_t), and growth domestic product (GDP_t). As before, each country of the EU has its own model, which means that 28 models are run in total (see Appendix III-22d). Consequently, equation (23) becomes (for $i = 1, \dots, 28$):

$$y_{t,i}^{**'} = (SE_t \ ML_{t,i} \ GX_{t,i} \ GDP_{t,i}) \quad (24)$$

Since the database is identical to the one in (A03), stationarity and data treatments are identical to 3.1.3 and 3.1.4. Nonetheless, the lag order is different from (A03) – models are reduced CSVAR based on equation (24), see Appendix III-22e. It has been decided here to use Akaike's Information criterion (AIC) because seventeen models have a lag equal to 8 if AIC is used, which consolidates our analysis. Indeed, it is more coherent to compare models that have a similar lag number. Moreover, orthogonal IRFs obtained with AIC seem to have a greater statistical significance (Annexes, [Graph III-4](#)), even if this is not always true, see Annexes, [Graph III-5](#).

Regarding results, orthogonal IRF are naturally less significant than results of model (A03) since less variables are run, see Appendix III-22 for all graphs and Appendix III-22b for IRF results. Nevertheless, there is no drastic change in

results' interpretation. The average of orthogonal shocks in step 0 is 0.0004, while it reaches 0.0003 for step 1 and 2. Consequently, a sanction shock still has an impact almost equal to zero. Regarding FEVD values, they consequently decrease in comparison to model (A03), see Appendix III-22c. It is coherent as there are less control variables in the model. The FEVD average thus reach 0.032 in step 1, and 0.045 in step 2.

4.3.2 Basic Linear Regression – (A03b)

Similarly to 3.3.2, basic linear regressions are run as robustness test. The general model is defined as (*for* $i = 1, \dots, 28$):

$$GDP^i = \beta_0^i + \beta_1 SE + \beta_2 ML^i + \beta_3 FDI^i + \beta_4 REER^i + \beta_5 HICP^i + \beta_6 LP^i + \beta_7 S^i + \beta_8 RD^i + \varepsilon^i \quad (25)$$

Variables remain as in 3.1.2 and 3.1.3, and are either in raw value or in logarithm. For instance, sanction (SE), key interest rate (ML) and foreign direct investment (FDI) are run as raw values (since they contain too many zeros), while others are run as logarithm. Let's remind that turning variables with many zeros into logarithm would ineluctably lead to a high number of missing values¹⁰⁷, and thus an insufficient number of observations to run regressions. Finally, *government expenditure* has been replaced by *gross savings* in order to try another theoretical assumption that is closer to the Austrian¹⁰⁸ perspective. A second set of regressions was therefore conducted using *government spending*, see Appendix III-23b. Interpretations resulting from these two sets of regressions are in the same vein.

The coefficient of determination average among models is equal to 0.945. Twenty models are above or equal to 0.94. Regarding the other eight, five models are above 0.9, and the other three are equal to 0.86, 0.83, 0.81, and 0.75. This is more than satisfactory for a robustness test. Here again, models' results confirm previous findings since in average, the estimated coefficient for sanctions is -0.00002537. See Appendix III-23 for details regarding estimations.

¹⁰⁷ Two series suffer from a small loss of values when turned into logarithm: savings for Luxembourg (8 missing values generated) and Cyprus (1 missing value generated). Yet, regressions can still be ran.

¹⁰⁸ Austrian School of economic thought.

TABLE III-24
BASIC LINEAR REGRESSION, KEY VALUES – (A03B)

<i>Model</i>	<i>R2</i>	<i>y1 coef</i>	<i>Model</i>	<i>R2</i>	<i>y1 coef</i>
1	0.9911	-5.46E-05	15	0.9400	8.74E-05
2	0.9855	1.79E-05	16	0.9888	1.82E-05
3	0.9664	-2.43E-04	17	0.8374	-8.28E-05
4	0.9300	-1.05E-04	18	0.9618	-6.50E-05
5	0.9706	1.65E-06	19	0.9692	-6.95E-05
6	0.9945	-2.29E-05	20	0.8673	7.92E-05
7	0.9776	-7.29E-05	21	0.9440	-1.33E-05
8	0.9333	3.31E-05	22	0.9481	-5.38E-06
9	0.9745	-4.66E-05	23	0.9951	-7.25E-05
10	0.9290	-2.38E-05	24	0.7555	-5.86E-05
11	0.9935	-1.41E-05	25	0.9681	-3.22E-05
12	0.9824	-1.35E-05	26	0.9896	2.27E-05
13	0.9021	5.35E-05	27	0.9617	-3.06E-05
14	0.8181	-1.22E-04	28	0.9838	1.24E-04

TABLE III-25
BAYESIAN LINEAR REGRESSION, KEY VALUES – (A03C)

<i>Model</i>	<i>y1 coef</i>	<i>Model</i>	<i>y1 coef</i>
1	-5.43E-05	15	9.02E-05
2	1.77E-05	16	2.07E-05
3	-2.40E-04	17	-8.76E-05
4	-1.05E-04	18	-6.35E-05
5	-8.98E-06	19	-6.22E-05
6	-1.67E-05	20	7.98E-05
7	-7.29E-05	21	-1.33E-05
8	3.79E-05	22	-5.09E-06
9	-4.37E-05	23	-7.25E-05
10	-2.38E-05	24	-5.74E-05
11	-1.26E-05	25	-3.45E-05
12	-6.25E-06	26	2.33E-05
13	5.17E-05	27	-4.44E-05
14	-1.12E-04	28	1.26E-04

4.3.3 Bayesian Linear Regression – (A03c)

As in 3.3.3, Bayesian linear regressions are now run in order to step out from the *frequentist approach*. Here again, estimations are obtained with MCMC, through a sample size equal to 10 000. Data used are identical to 3.3.3. Results are once again in line with previous findings. Indeed, the average value of sanction coefficients is -0.00002466; all coefficients fall within the 95% confidence interval, see Appendix III-23c for further details.

4.4 Russia's GDP

After having examined sanctions' effects on growth rates of European GDPs, it is now logical to focus on their impact on Russia's one. Since this part will examine one country, and because the logic is exactly the same to what has been done before, it will naturally be shorter.

4.4.1 Architecture, Framework, Choice of Variables, Stationarity and Lag Order

As before, let's try to capture effects of coercive measures on economic growth to assess whether there is a *sanction ripple effect* or not. One CSVAR is run because only one country is studied: The Russian Federation. The study period starts in 2003q1 and ends in 2019q4. Data's frequency is quarterly and gathers 67 observations. The vector of endogenous variables y_t^Ω for $(t = 1, \dots, 67)$ is defined as:

$$y_t^\Omega = (SE_t \ ML_t \ FDI_t \ REER_t \ CPI_t \ LF_t \ GS_t \ GX_t \ GDP_t) \quad (26)$$

It has eight domestic variables (specific to Russia) and one external variable. Marginal lending key interest rate (ML_t), foreign direct investment (FDI_t), real effective exchange rate ($REER_t$), consumer price index (CPI_t), labour force participation (LF_t), gross savings (GS_t), government expenditure (GX_t), and gross domestic product (GDP_t) are domestic variables. The sanction index (SE_t) is an external variable. Here again, GDP is ordered last as it is the variable of interest. The sanction index is the causal variable and is ordered first, while variables in-between are control variables. The choice of variables follows what is described in 4.1.2. As labour productivity is not available¹⁰⁹ for Russia in the required frequency and time span, it is replaced by labour force participation. This choice seems coherent because labour force participation is also able to influence growth, see [Toossi \(2013\)](#), [Lechman and Kaur \(2015\)](#), [Tsani et al. \(2015\)](#), [Lahoti and Swaminathan \(2013\)](#), *et cetera*.

Data treatments for ML_t , CPI_t , and OIL_t are identical to what is detailed in 3.1.3 since these variables are coming from subsection (A02). GDP_t is from subsection

¹⁰⁹ It might be available in private databases, or paid ones, but the author has only access to free and public databases.

(A01) where it is named “foreign income”, and thus follows what has been done in 2.1.3. The sanction index (SE_t) remains as defined earlier. Since many variables were in U.S. dollars, it seemed coherent to convert them into euros in order to ease future interpretations –to fit previous models of this subsection. It has been done with the European Central Bank reference rate, U.S. dollar / euro. Labour force participation was initially yearly and had to be turned into quarterly (low to high frequency, linear, match first). This transformation naturally led to three missing values (2019q2, 2019q3, and 2019q4), which were forecasted through exponential trend regression. The growth rate of the predicted series was used in order to forecast missing values, because doing so avoids creating “breaks” (i.e. gaps between the predicted series’ values and original series’ values). Foreign direct investment was first converted into euros, and then followed identical treatments. Gross savings followed the same drill, but were predicted through a log reciprocal regression and then turned into euros. Regarding the stationarity of data, all series failed to pass Clemente–Montañés–Reyes test, but ML_t , FDI_t , $REER_t$, CPI_t , GX_t and GDP_t successfully passed GLS-ADF test. GS_t and LF_t failed GLS-ADF but managed to pass the classic ADF test, see Appendix III-24. The selected lag order is 8 since AIC, HQIC, and SBIC all lead to it, see Appendix III-24b. See Appendix III-24c for details regarding the model.

TABLE III-26
DATA SOURCE – (A03E)

<i>Variable</i>	<i>Details</i>
GDP_t	Foreign Income – Organization for Economic Co-operation and Development; gross domestic product by expenditure in constant prices: total gross domestic product for the Russian Federation [NAEXKP01RUQ652S], retrieved from FRED, Federal Reserve Bank of St. Louis.
LF_t	Labour Force Participation – World Bank; Labour force participation rate, total (% of total population ages 15-64) (modelled ILO estimate).
GS_t	Gross savings – World Bank; Gross national income less total consumption, plus net transfers; data in current U.S. dollar.
$REER_t$	Real Broad Effective Exchange Rate – Federal Reserve Bank of St. Louis Economic Data; Real broad effective exchange rate for Russia, index 2010=100, monthly, not seasonally adjusted.
GX_t	Government Final Consumption Expenditure in Russian Federation – Federal Reserve Bank of St. Louis Economic Data; Government Final Consumption Expenditure in Russian Federation, Russian Rouble, Quarterly, Seasonally Adjusted.

FDI_t	Foreign Direct Investment – International Monetary Fund; Foreign direct investment, net inflows (BoP, current US\$) - Russian Federation; Balance of Payments database, supplemented by data from the United Nations Conference on Trade and Development and official national sources.
CPI_t	Consumer Price Index of Russia – Federal Reserve Bank of St. Louis; Consumer Price Index: All Items for Russian Federation, Index 2015=100, Quarterly, Not Seasonally Adjusted.
ML_t	CBR Marginal Lending Facility – Federal Reserve Bank of St. Louis; immediate rates: less than 24 hours: Central Bank rates for the Russian Federation; percent; quarterly; not seasonally adjusted.
$SE_{t,i}$	Sanction Index (European Sanctions) – Bali et al. (2020); the index construction is detailed in Chapter II; index values available in Annexes, Table II-s .

4.4.2 Results & Robustness Tests

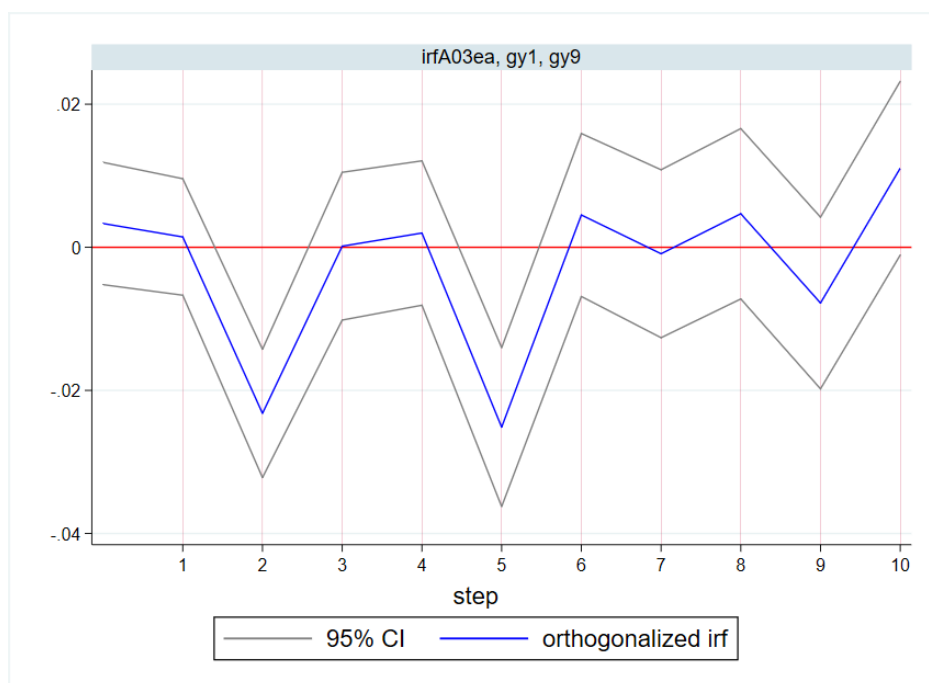
The value of orthogonalized IRF in step 0 is 1.80E-15, it then reaches -4.50E-16 in step 1, and 2.20E-15 in step 2, see Graph III-6. As for other models of this subsection, it seems clear that sanctions have no effects on Russia's GDP quarter-on-quarter growth. More surprisingly, FEVD values are quite low (0.049414 in step 1, 0.040935 in step 2, and 0.061037 in step 3), see Appendix III-24d. It means that sanctions explain only a small share of unexplained changes of the Russian GDP. As before, the first robustness test is the reduced SVAR run on the basis of four variables (SE_t , ML_t , GS_t , GDP_t). The methodology remains as in (A01) and (A02). Results confirm that sanctions have almost no effects on Russia's GDP, see Appendix III-25. The second robustness test is achieved through a linear regression, and also confirms previous findings, see Appendix III-25b. Finally, the last robustness test (Bayesian regression) also supports previous findings, see Appendix III-25c.

4.4.3 Additional Model – (A03ed)

It also seems interesting to try an additional CSVAR that integrates Brent oil prices. It makes sense since Russian exports (and thus economic growth) are highly dependent on oil prices. Additionally, it has also been demonstrated earlier that a collapse of Brent prices also affects the Russian currency. Consequently, integrating oil is a way to capture effects on Russian exports and eventual monetary consequences. The framework is identical to what was done in 4.4.1, except that Labour Force Participation is replaced by Brent oil prices. Oil is coming

from subsection (A02), but has been turned into euros in order to fit our model's currency choice. This new series fails to pass Clemente–Montañés–Reyes test, but successfully pass GLS-ADF test, see Appendix III-26. The number of lags is 8 since it is the one given by all tests (AIC, HQIC, SBIC), see Appendix III-26b. Using Brent instead of labour force participation highly increases statistical significance of the model. It also slightly changes the sense of the orthogonalized IRF¹¹⁰ as it becomes negative from step 0 (-3.9e-15) to step 2 (-3.0e-14). FEVD values¹¹¹ are still low but seem to increase over time (0.040052 in step 1, 0.189299 in step 2, and 0.654425 in step 3). Consequently, results don't change drastically, but the statistical significance of OIRF increases, see Graph III-7. Robustness tests are identical as before and once again support results, see Appendix III-26d.

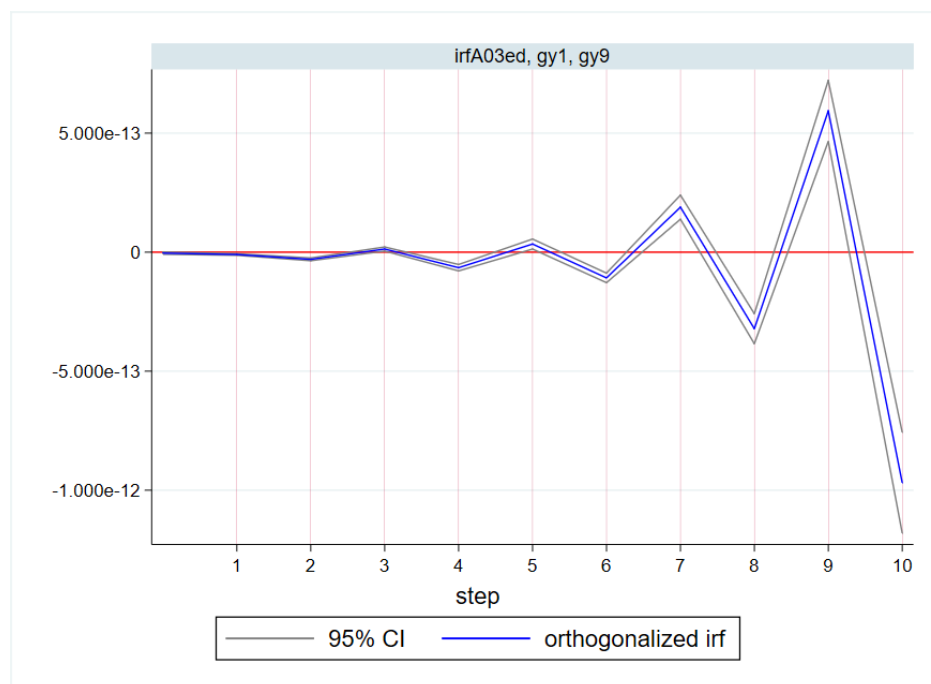
GRAPH III-6
IRF - RUSSIA'S GDP RESPONSE TO A SANCTION SHOCK



¹¹⁰ Appendix III-26c.

¹¹¹ Ibid.

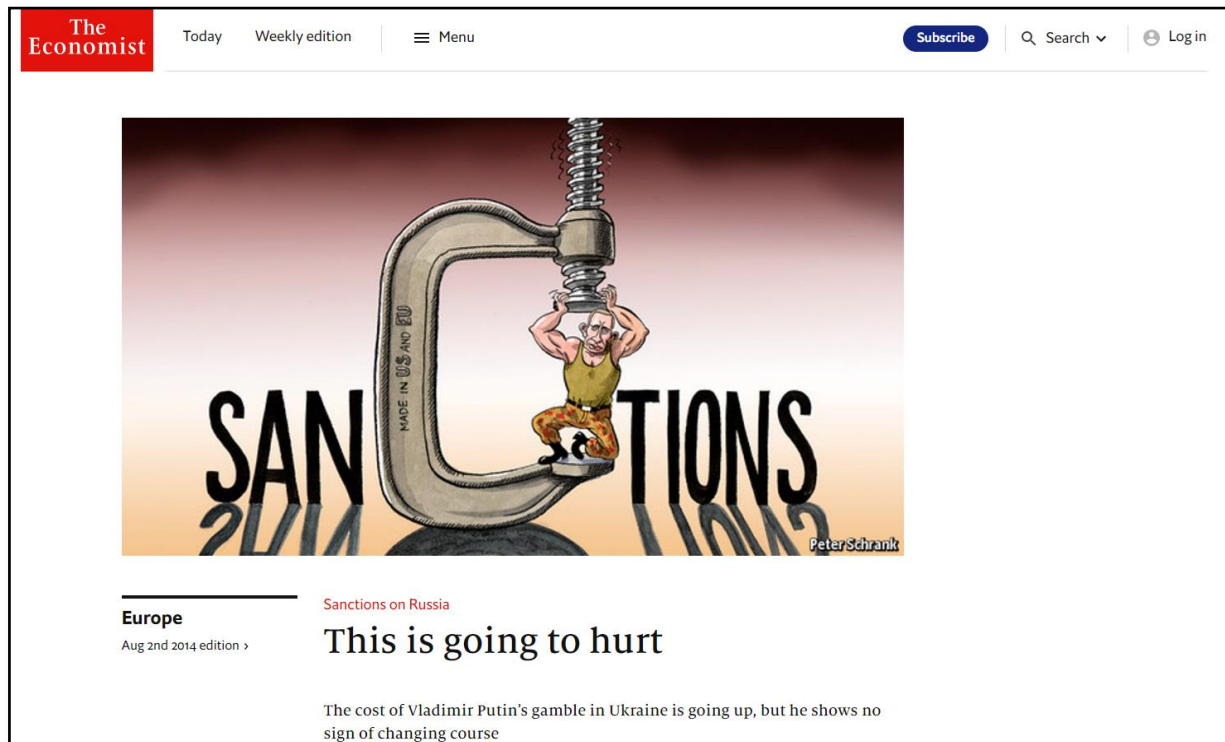
GRAPH III-7
IRF - RUSSIA'S GDP RESPONSE TO A SANCTION SHOCK



5. Conclusion

This chapter has a highly quantitative dimension. As it is, it can be quite hard to read and to understand by someone who is not much into statistics and econometrics. In fact, even a statistician-econometrician could have some issues with it if he is not familiar with SVAR models. That is particularly true because of the adopted methodology, and its high number of models. Knowing this, one tried to ease the reading as much as possible by gathering models, databases explanations, tests, and results. Moreover, a very special attention was paid to uniformity. Nonetheless, this is not enough, and it seems crucial to establish a real rupture with this truly quantitative content, by explaining results in a way that would reach a larger audience. Let's try to achieve this here. The impact of economic sanctions on trade between the European Union and Russia, as much as their effects on economic growth has been examined. Each country involved was studied independently from others and followed a similar methodology in order to compare apples with apples and pears with pears. This econometric analysis has been achieved to answer to the several assumptions made in Chapter I. Among

them is the existing uncertainty related to the main reason for trade decrease between the EU and Russia.



Note: Screenshot from *The Economist Newspaper*.

For instance, the decrease of total exports to Russia from the European Union reaches €111,220,000,000¹¹². Yet, under-embargo products account for only 14.05% of this decrease. The question raised earlier is to know if coercive measures could be held responsible for the 85.95% left. Similarly, the observed decrease of Russia's exports to the EU reached €219,160,000,000¹¹³. As European sanctions almost didn't target these products, one can also wonder if coercive measures have something to do with this decrease. Finally, our second objective was to know if diplomatic punishment really had an effect on the economic growth of economies involved. If the eventuality of European economies being impacted by their own sanctions didn't make much noise in most media, many were delighted to attribute the Russian recession to economic sanctions. For example, *The Wall Street Journal*¹¹⁴ was speaking about the "first bite" of sanctions, while the *Financial Times*¹¹⁵ supported the idea that Russia's economic slowdown was due to sanctions.

¹¹² Difference between the witness period (2009m5 – 2014m8) and the test period (2014m9 – 2019m12).

¹¹³ Ibid.

¹¹⁴ <https://www.wsj.com/articles/putin-says-russia-should-refrain-from-more-retaliation-against-u-s-1395396163?tesla=v#printMode>

¹¹⁵ <https://www.ft.com/content/920dbf76-8f5a-11e4-9ea4-00144feabdc0>

*The Economist*¹¹⁶ was even more confident, blustering that “This is going to hurt”. Similar examples among Western European media are numerous, and it seems that many love to count their chickens before they are hatched. However, our models’ results shall get things clear.

Orthogonalized IRF lead us to the fact that it is not possible to state that European sanctions had a direct effect on products untargeted by the embargo and exported to Russia. It doesn’t happen right after the implementation of sanctions nor several months later. This is also true for Russian exports to European countries. There is no statistical relationship between their decrease and sanctions. Nevertheless, there is a real and statistically significant evidence that coercive measures still played their part in another manner. Indeed, results reveal that sanctions are able to explain a consequent share of unexplained variations of European exports to Russia, and *vice versa*. Naturally, this share depends on the export destination. For instance, if coercive measures explain 99.2% of unexplained changes of Cyprus’ exports to Russia, they barely explain 0.005% of Poland’s exports to Russia (see Table III-6). Thus, it seems coherent to display these results on a map (MAP III01), in order to see at a glance how diplomatic measures affect exports. Cyprus, Latvia, Portugal, Denmark, The United Kingdom, Slovenia, Netherlands, Germany, Sweden, Austria, and Romania, are all at 80% or more. It seems hard to explain why them and not others, since there are not many similarities among them. Germany and The United Kingdom are among the 10 greatest exporters to Russia. Others do not contribute much to the total of the EU exports to Russia. Even when trade is decomposed in main products categories, no interesting facts arise. Moreover, there is no common points within the trade decomposition of these countries’ exports to Russia, except that they fit the average of the EU. Their GDP is quite different, from \$3,948,000,000,000 for Germany to \$28,000,000,000 for Cyprus (World Bank Data, for 2018). Finally, there is not a clear geographic commonality that can be found. Economic sanctions are also able to explain unexplained changes of Russia’s exports to the EU. The country analysis is once again useful as it shows real differences depending on the destination

¹¹⁶ <https://www.economist.com/europe/2014/08/02/this-is-going-to-hurt>

country. For instance, coercive measures can explain more than 80% of unexplained changes of Russia's exports to Belgium, Latvia, Luxembourg, the Czech Republic, Hungary and Portugal. Again, it is hard to find coherent trends within these countries that could explain why the sanction ripple effect influences them more than others.

Results are in the same vein regarding the effect of coercive measures on economic growth. For instance, it is possible to conclude that sanctions do not have a direct effect on the economic growth of both European economies and Russia. This finding is robust, and statistically significant. As with trade, countries react differently, and MAP III-03 allows us to observe these differences easily. Thus, Slovakia, Poland, Slovenia, Austria, the Czech Republic, France and Spain can be put aside from others. Sanctions explain more than 80% of unexplained changes of their quarter-on-quarter economic growth. It is once again really hard –if not impossible– to find a coherent and legitimate common ground between these countries. Nevertheless, these results demonstrate that the sanction ripple effect is also able to affect players' economies. Moreover, this effect is surprisingly low for the Russian Federation.

TABLE III-27
SANCTION RIPPLE EFFECT ON TRADE AND GROWTH

<i>Countries</i>	<i>Exports to Russia</i>	<i>Imports from Russia</i>	<i>Economic Growth</i>
Belgium	+	++	+
Latvia	++	++	-
Portugal	++	++	-
The Czech Republic	-	++	++
Slovenia	++	-	++
Netherlands	++	+	+
Austria	++	-	++
Romania	++	-	+
Bulgaria	+	-	++
Malta	-	+	+
Lithuania	-	+	+
France	-	+	++
Poland	-	-	++
Russia	∅	∅	-

Note: “++” indicates an effect >80%; “+” means that the effect is between 50% and 75%; “-” means <50%.

To conclude, it has thus been demonstrated that there is a sanction ripple effect on trade between the EU and Russia, as much as on the economic growth of many European economies. Hence, it seems important to highlight that if almost all countries are affected by it, some countries cumulate a particularly strong sanction ripple effect on both trade and economic growth. For example, Belgium's exports to Russia, imports from Russia, and economic growth are all affected by it. Table III-27 summarises these results, retaining only the strongest ripple effect. Thus, if this effect has a common nature for both players, its intensity differs. Indeed, for trade, it is in average 27.2%¹¹⁷ stronger for the European Union than for Russia. But the main finding is that while this effect is quite low for Russia's economic growth (4.9%), it is high and consequent for many European countries (up to 97.16%, with an average reaching 49.98%). In consequence, it means that in addition to failing to have a direct impact on Russia, European measures can indirectly affect their senders (European countries). It is even more paradoxical to know that Russia has been spared these indirect effects.

Chapter's Endnote – Additional Robustness Tests

Rolling-window analysis has been conducted in order to assess the stability of our models over time. It is also a good method to ascertain our results' significance (IRF and FEVD). Subsections A01, A02, A03, and A03e initially start in 2003q1 and end in 2019q4. As most sanctions started in 2014q4, it means that 21¹¹⁸ observations capture sanctions' effects while 47¹¹⁹ don't. There is thus a difference of 26 observations. This gap might create statistical disruptions that could affect our results. Consequently, it has been decided to create new databases that start in 2009q4. By doing so, the before-sanctions period has now 20 observations, which is identical to the during-sanctions period. In total, 85 models are run twice. It is run once with lag values that are identical to what was initially done in A01, A02, A03 and A03e, and a second time with lags obtained from new tests (Appendix III-28, III-28b, III-28c, III-28d). It thus leads us to 170 models.

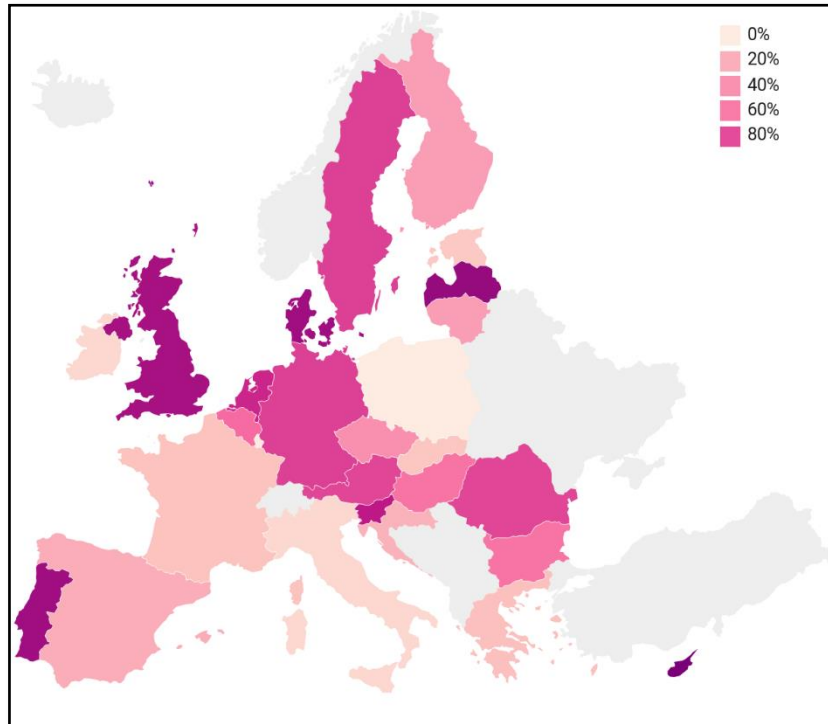
In both situations, all models that are run keep a great statistical significance, with OIRF results in line with Chapter III's results. FEVD values slightly change when models are run with identical lag to what was initially done; A01 FEVD values increase by 12.4pp in average, A02 ones decrease by -4.1pp in average, A03 ones by -11.5pp in average, and A03e values decrease by -15.1pp in average. When new lags are used, the difference with original models is bigger, but this is mostly explained by the fact that new lags are lower in average. Consequently, this last robustness test confirms our main result: sanctions do not have a direct effect on the chosen causal variables. Reducing the period span can, however, slightly change FEVD values. See Appendix III-29, III-29b, III-29c, III-29d, III-30, III-30b, III-30c, III-30d, for FEVD detailed values.

¹¹⁷ That is the difference between the average FEVD of models from subsection A01, and those from subsection A02.

¹¹⁸ From 2014q4 to 2019q4.

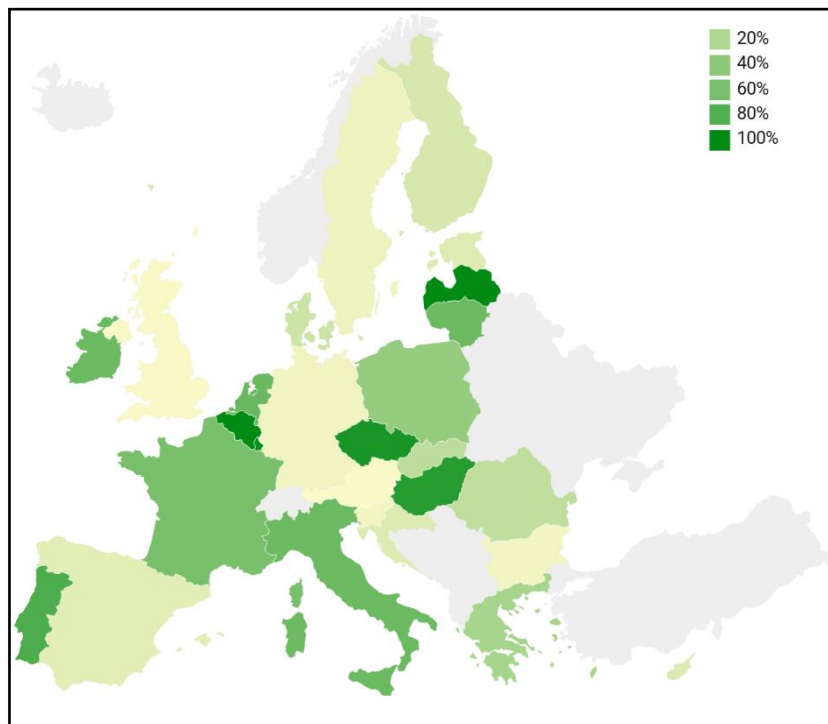
¹¹⁹ From 2003q1 to 2014q3.

MAP III01
SHARE OF SANCTIONS IN UNEXPLAINED CHANGES OF THE EU'S EXPORTS TO
RUSSIA



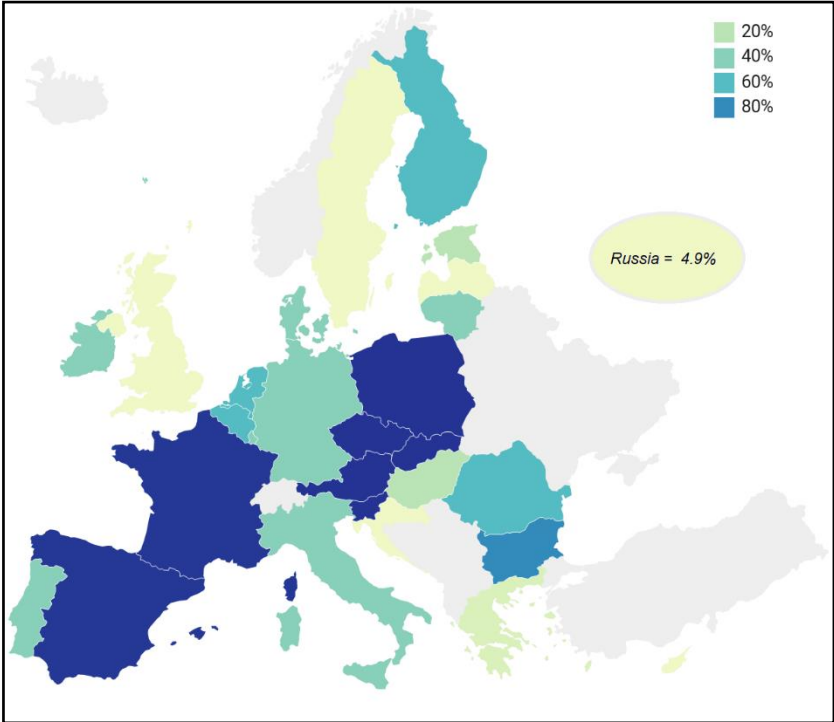
Note: One quarter after the sanction shock, see Table III-6, step I.

MAP III02
SHARE OF SANCTIONS IN UNEXPLAINED CHANGES OF RUSSIA'S EXPORTS TO THE
EU



Note: One quarter after the sanction shock, see Table III-15, step I.

MAP III03
SHARE OF SANCTIONS IN UNEXPLAINED CHANGES OF GDP



Note: One quarter after the sanction shock, see Table III-22, step I.

4

Conclusion

The first time I set foot in Russia was in 2016 as part of my Master's degree research stay. My goal was to run a comparative analysis on the impact of sanctions on the Russian rouble, in comparison to effects due to oil prices collapse. I had never been working on international coercive measures before. Moreover, it was also my first attempt to put myself in the shoes of a researcher, and my knowledge in statistics-econometrics was quite low. Consequently, I had to assimilate a lot in a very short period of time, which was far from easy. In France, only a few understood my sudden interest in Russia and economic warfare. Among them was Professor Eric Brunat, who then became my PhD thesis supervisor. As public opinion on Russia was –and still is– quite negative, it was hard to organise this stay. Nevertheless, I was more than satisfied from this experience and I returned home knowing that my PhD would focus on the study of economic sanctions. I also knew that it would be crucial to reiterate stays in Russia, in order to extend my scientific network –essential to my future doctoral thesis.

What I did not know is that it would be so hard to start a joint PhD between France and Russia. I expected some administrative issues, but I definitely didn't expect to be slowed down –as much as I have been– by people for whom Russia is a great evil, and for whom it is unbearable to head there to live and study. In fact, I quickly understood that my research field was sensitive, and that it would be hard to peacefully conduct a research on it. If my investigation would lead to the fact that Russia was not much hurt by Western punishment, it would mean –for some people, that I am “pro-Putin”. Reversely, if I would find that the Russian economy was plunged into recession because of international sanctions, some others would gladly identify me as “pro-Atlanticism”. Believe it or not, I did experience it and I am not over-exaggerating any of that. This is why I have decided to provide a highly quantitative content in my work. Hence, statistics and econometrics allied to full transparency and reproducibility of my research safeguard this thesis' neutrality.

Foreseeable Failure

The use of economic coercive measures as a diplomatic tool rarely works, see [Hufbauer et al. \(1997, 1990a, 1990b\)](#), [Pape \(1998, 1997\)](#), [Dashti-Gibson et al.](#)

(1997), [Drury \(1998\)](#), *et cetera*. This is mostly explained by the inability of the sender to inflict a considerable economic pressure to its target. Sanctions are often implemented with haste, without any robust and careful preparatory study. That is probably due to the *sanction dilemma*¹²⁰ that policy makers are facing. As a matter of fact, a diplomat from a country of the EU that I had the opportunity to meet during my stay in Saint-Petersburg admitted to me –off record– that sanctions had been decided because no one knew what else could have been done. Consequently, they were not well prepared, and the necessary conditions for their success were ignored. Sanctions of the European Union can be considered as *weak sanctions* –see [Doxey \(1980\)](#), and thus had low chances to succeed, see [Whang \(2010\)](#). If the EU would have really wanted to create a strong economic pressure on Russia, the oil industry would have been targeted harder, and in a way that would not have led space for circumvention strategies. Additionally, it would also have been necessary to hit hard the gas industry, which has been spared. For example, a costly but strong measure would have been to stop importing raw resources from Russia (or to decrease their import). Naturally, it would have been necessary to find these resources elsewhere, and certainly for a higher price. Moreover, it would have also been onerous in another manner by creating an exposure to an even harder Russian response, such as the closure of Russia's airspace to European countries. The thing is that Western countries could have implemented strong measures, but they did not, probably because they were not willing to assume their costs and consequences.

Coercive measures against Russia were scattered and quite unclear for economic actors. The European Union did not even clearly list products under sanctions in some cases¹²¹. Instead of targeting one precise sector in a very strong way, several soft regulations were imposed. Yet, as explained in [Morgan and Schwebach \(1995\)](#), scattered measures lead to scattered economic pressure. Besides, the number of issuing countries was not high enough, which mechanically decreased sanctions' effectiveness, see [Neuenkirch and Neumeier \(2015\)](#). To be precise, many countries

¹²⁰ As explained in the literature review, [p. 8](#).

¹²¹ "Primary responsibility for the classification of goods and technologies lies, however, with those responsible for sending or receiving such items." (Commission Guidance note on the implementation of certain provisions of Regulation (EU) No 833/2014, p. 3).

didn't wish to get involved in this economic conflict (Eurasian countries, China, India, Africa, South American countries), thereby facilitating Russia's ability to circumvent economic punishment. Make no mistake about it, this is even truer in a reverse way since Russia also failed in gathering other countries around its goal. By implication, the *third-country effect* –see [Bonetti \(1998\)](#)– was highly likely to happen for both Russia and the EU. Even the strongest measures would have resulted in a failure as soon as both players were able to use third countries –that didn't commit to economic punishment– in order to circumvent sanctions. Nonetheless, it would be wrong to say that European sanctions forced Russia to find new trading partners, as they were not targeting trade. It seems allegedly more correct to say that the Russian embargo encouraged Russia to curve new trading channels, giving time to the country to prepare its import substitution strategy.

From another perspective, it would have been wrong –and still is– to say that players were allies. Consequently, both Russia and the EU were not threatened by the rupture of smooth relations, see [Galtung \(1967\)](#). The fear of losing a good ally was not relevant, and the literature already showed that in such conditions, threats of increasing and repeating economic sanctions are unable to bring the sanctioned country to its knees, [Whang \(2010\)](#). As if it is not enough, the lone objective of European sanctions can be qualified as not “modest”, since it is certain that the Russian Federation would not have moved backwards regarding Crimea's annexation. As a consequence, it was once again highly unlikely that these sanctions reached their goal, [Bonetti \(1998\)](#). This is also true regarding Russian counter sanctions. Hence, it might explain why Russia needed almost six months to announce the embargo implementation. It seems coherent to assume that a considerable work was achieved in order to choose which products shall be included in the embargo, depending on induced incurred costs to which they would lead.

The duration of sanctions also did not bode well for future. Indeed, actions taken against Russia did not have a termination date and have been constantly extended. Therefore, since Russia announced that its countermeasures would not be lifted until European sanctions are withdrawn first, an endless vicious circle is still

ongoing at the time of writing. Unfortunately for countries involved, there is evidence that the sanctions efficiency decreases over time, see [Neuenkirch and Neumeier \(2015\)](#) or [Hufbauer et al. \(2003\)](#). Thus, implementing sanctions and hoping that the target would one day comply does not make any sense. As soon as Russia announced counter sanctions, it should have been clear for Western policy makers that their goal would not be reached. Thence, one can legitimately wonder why sanctions keep being renewed more than six years after their first implementation; this inexplicable relentlessness seems to be more symbolic than anything else. If so, countries involved shall probably lift their sanctions and think about a truly symbolic diplomatic answer, which would bring a fresh impetus to Russian-European economic relations.

Finally, one must understand that from the Russian perspective, Russia absolutely did nothing wrong. A lost territory was taken back as a result of people's choice – the 2014 Crimean status referendum, and eventually, ethnic Russians from the Donbass were helped. Thus, Western punishment against these actions had every chance of leading to political integration within the Russian Federation, and it probably did. For instance, Vladimir V. Putin's approval rating reached a record of 89%¹²² in June 2014, after Crimea's annexation. In such situation, it seems coherent to consider that even hard sanctions that would have had some significant impact on the Russian economy would not have reached their goal. They could have even been taken as external interference in Russia's affairs, [Galtung \(1967\)](#). Moreover, Russia has gigantic natural endowment because of its surface, which means that the country could be self-sufficient regarding its primary needs (if Cuba did, Russia could as well).

Lack of Economic Pressure

As previously stated, by ignoring and neglecting findings of the literature, sanctions were not able to apply a strong economic pressure. As a result, both sides failed in obtaining what they wished to accomplish. In this thesis, a quantitative analysis was conducted in order to capture sanctions' effects. It has been decided

¹²² <https://www.theguardian.com/world/datablog/2015/jul/23/vladimir-putins-approval-rating-at-record-levels>

to focus on trade and economic activity. Chapter I revealed that trade between Russia and the EU fell by a fifth, which is curious as almost 95% of goods composing this decrease are out of the sanctions range. This fact by itself was a great sign of the *sanction ripple effect*. Moreover, it was also demonstrated that not a single country of the European Union fully committed to the Russian embargo. Indeed, some exports of under-embargo goods still happened after the implementation of Russian measures. Yet, if it is true that some countries might have been used as third party or gateway countries, this phenomenon remains insignificant. For instance, exports of under-embargo goods that could have been achieved for re-exportation motives –to Ukraine, Belarus, and Norway, do not even cover 3% of the total decrease of European exports of under-embargo goods to Russia. Thus, it seems to indicate that most European economic actors didn't even bother to hide their prohibited flows. Surprisingly, among these three, Ukraine is the country where most of these goods were exported. Even if causality cannot be proven, it seems highly unlikely that Ukraine's domestic market suddenly needed that much cheese and else for its own needs –this quantity being far from historical values.

Be that as it may, it became necessary to know if the overall decrease of trade between the EU and Russia occurred because of sanctions. It was also necessary to find real evidence of the *sanction ripple effect*. To that end, under-embargo goods were removed from trade flows (leaving us with data for which the decrease remained unexplained), and 342 country structural vector autoregression models were run. They were studying the economic impact of coercive measures on European exports to Russia, on Russia's exports to the EU, and on the GDP of involved players. Results are unequivocal. European sanctions didn't have a direct effect on exports of goods untargeted by the embargo. They also didn't have any direct effect on Russia's exports to the European Union, nor on quarter-on-quarter economic growth of economies involved. It is thus clear that European sanctions failed in applying economic pressure on the Russian economy. Reversely, the Russian embargo also didn't succeed in applying a consequent economic pressure on European countries. It happened mostly because Russia's share in most European countries exports of under-embargo goods is quite low. Nevertheless, all

models succeeded in demonstrating the presence of the *sanction ripple effect*. To be clear, it means that European sanctions had a real indirect effect on European economies and on their trade with Russia. Trade as much as economic growth were indirectly impacted by the disruptions induced by European punishment. Nonetheless, results also demonstrated that Russia was much less impacted by the *sanction ripple effect* than European countries. Indeed, indirect effects on trade are in average 27.2% stronger for the EU than for Russia, while the same effects are almost non-existent (4.9%) for Russia's economic growth (they are up to 97.16% for the EU, with an average of 49.98% among European countries).

Boundaries

Even if results of this doctoral study are statistically significant and robust, several limitations shall be mentioned. The methodology used is quite untypical, and its innovative nature can be criticised. The first sanction index was introduced by [Dreger et al. \(2015\)](#) and then used in [Kholodilin and Netsunajev \(2016\)](#). To be clear, these two papers were still in working paper form when this PhD work started. They have now been published as [Dreger et al. \(2016\)](#) and Kholodilin and Netšunajev (2019). However, it has been necessary to create a new sanction index because of their index's limitations. This new index, though, also has its own limits. The main one being the arbitrary nature of the Alpha parameter, see Chapter II. Thence, since all models run in this doctoral work use the sanction index as causal variable, their results are mechanically influenced by it. Nevertheless, one shall remember that science was built on heuristics and that if it is true that the Alpha parameter has an arbitrary nature, it doesn't mean, however, that its construction is not logical and coherent. There is still a lot of work to achieve in order to obtain a sanction index that has minor limitations, but it would not have been reasonable to follow this path in this thesis –cost-efficiency would not be optimal because of the time constraint that is surrounding us.

From another perspective, it is true that some other type of econometric models made its way in our science since the beginning of this work. Thus, it would be easy to blame the author for his choice, as some might argue that structural vector autoregression models (SVAR) are out-of-date. If it is true that SVAR start to be

old-fashioned, it is nonetheless essential to bear the time constraint in mind. To be clear, the use of CSVAR allowed us to provide a wide economic study in a relatively “short” time. Each country of the European Union has been examined as much as the Russian Federation. Moreover, the methodological set-up allowed us to smooth the analysis and to avoid questionable comparisons of the involved players. For instance, it would have been way harder –in terms of time consumption– to achieve this using time-varying parameter vector autoregressive models (TVP-VARs). Having said that, the author can only be curious about the possible outcomes resulting from redoing this thesis’ work with TVP-VARs. However, for the time being, this door is left open to future studies. Another criticism could be that this work has a limited study area. Indeed, after all, models run focused “only” on trade and economic growth. It could have been possible to examine sanctions’ effects on unemployment, savings, private investments, and so on. Even if it seems logical at first glance, reproaching that to the author entails an important omission: results do not reveal any direct effect on trade and economic activity. Consequently, refining the analysis by including components of trade or GDP would have probably led to similar results. In addition, it would have been a considerably time-consuming task that would require data at the micro-economic scale for the twenty-nine involved economies. Naturally, this is only an intuition and it would be interesting to double check it in further studies. As a final remark, let’s remember that sanctions are subject to countries’ features. International alliances, economic diversification, historical background, institutional development level, resources dependences, and so on, are elements that influence the ability of sanctions to inflict economic pressure. Unfortunately, most of these elements are hard to integrate to econometric models. If the sanction index is able to indirectly integrate these aspects, it doesn’t allow us to dissociate one from another.

Philosophical Considerations

“Repression by brute force is always a confession of the inability to make use of the better weapons of the intellect—better because they alone give promise of final success.” (Mises (1962), Chapter I, section 10. The Argument of Fascism, fourth paragraph before the end of the section).

It is essential to consider that there is really little that is known about the disruptions induced by economic punishment. The econometric tool –as useful as it is– does not allow us to catch everything. Models used are still too limited, and many variables are forgotten or left out because of technical restrictions. Hence, one must admit that technology does not allow us to create models that would integrate as much data and variables as required to faithfully capture the economic reality. Besides, the use of macroeconomics binds us to an overall picture of our study subject. Reversely, microeconomics –as it is achieved nowadays– also meets technological limitations, more particularly in the process of data collection and treatment. Furthermore, it would be presumptuous –and pretentious– to assume that political economics or any other type of qualitative approach could be able to catch the tremendous complexity of the economy. To achieve such a feat, one shall know and integrate all the interdependent elements that constitute the economy, which seems –for now– beyond human abilities. As Friedrich August von Hayek said in his masterpiece, “Law, Legislation and Liberty”:

“Complete rationality of action in the Cartesian sense demands complete knowledge of all the relevant facts. A designer or engineer needs all the data and full power to control or manipulate them if he is to organize the material objects to produce the intended result. But the success of action in society depends on more particular facts than anyone can possibly know. And our whole civilization in consequence rests, and must rest, on our believing much that we cannot know to be true in the Cartesian sense.” (Hayek (1978), Chapter I, The permanent limitations of our factual knowledge, second paragraph).

To go further, I must recognise that F.A. Hayek had a highly inspiring role here. Particularly with his concept of order, which he defines as:

“a state of affairs in which a multiplicity of elements of various kinds are so related to each other that we may learn from our acquaintance with some spatial or temporal part of the whole to form correct expectations concerning the rest, or at least expectations which have a good chance of proving correct” (Hayek (1978), Chapter I, The concept of order).

In this definition, F.A. Hayek uses the work of L.S. Stebbing who states that when we know how a set of elements is ordered, we have a basis for inference, see [Stebbing \(1933\)](#). Yet, as explained before, policy makers do not know how elements are ordered. Thenceforth, it seems almost impossible for a government to establish an efficient and successful economic punishment, precisely because many essential forces and parameters remain unknown. Alas, even if these elements were known, it is through its own implementation that economic coercion would probably lead to failure, no matter which measures would be adopted. Indeed, when actions are taken against a country's economy, they create economic disruptions –the *sanction ripple effect* could be an evidence of this, which in turn threaten the economic order. By doing so, sanctions lead to a new economic framework that is unknown and hard to forecast for policy makers. It is mostly because interactions between economic actors that compose the open world trade are numberless. Because of the lack of information, any assumption regarding future consequences of economic punishment becomes arbitrary. Thus, by perturbing the economic equilibrium that was in place before the implementation of coercive measures, governments expose themselves to an inevitable random walk. In such situation, consequences could sometimes be beneficial, sometimes catastrophic, and no one could predict them.

Another aspect that shall be discussed concerns freedom. How free are economic actors that are held hostage by economic war? It seems that they are not free at all! For instance, from one day to the other and without warning, some French farmers and breeders had to deal with the loss of a great trade partner. They probably did not know much about what was happening in Donbass or in Crimea. They probably did not care much about it neither. Yet, they had to stop their activity with their Russian partners because of it. Let's not mention all these business owners who saw their activity simply disappear because of sanctions. There are also those who were depending on jobs which were created by the past

trade relationship between the European Union and Russia. Alternatively, it also did a lot of harm on future economic projects. All the companies that have not been created, all the new partnership that have been cancelled, and so on. On both sides, economic actors suddenly lost their freedom. The legitimacy of such measures can only be questioned as these actors are not public entities. Thus, by restricting their activities for the sake of some political and diplomatic beliefs, governments used them as necessary tools for their plans. When a company has three quarters of its exports heading to Russia, blocking these flows is equivalent to putting it out of business. Moreover, a parallel can be drawn between economic war and war at all. Treaties and agreements regulate war, and some things are strictly forbidden. For example, non-military personnel shall not be attacked. The Geneva Conventions created international standards and laws regarding humanitarian treatment during wars. Yet, there is no equivalent regarding economic war and the use of coercive measures. It is without any limitation that governments can introduce these measures. Some of them even directly target civilians, such as American sanctions against Iran that restricted the access to several drugs for many Iranians, disallowing them to heal themselves. Moreover, the principle of extraterritoriality of U.S. laws regarding sanctions is also questionable. For instance, America is often threatening countries or economic actors that trade with an entity under U.S. sanctions. Hence, companies can end up on trial in the U.S. and risk consequent financial penalties –as European companies that trade with Teheran, even if European law is evolving in order to find an appropriate answer to these coercive mechanisms.

To Conclude

In this thesis, the effectiveness of economic sanctions in the context of the Ukrainian crisis has been investigated. A complete literature review of sanctions has been achieved, trade flows between the EU and Russia were examined (dissociating product under-embargo from others), a new sanction index has been created, and 342 CSVAR were run. It seems that coercive measures that have been taken on both sides are a failure. Negative externalities –*illustrated by the sanction ripple effect*– that are coming from this economic conflict are costlier to the

European Union than to Russia. Moreover, it somehow triggered a protection mechanism from the Russian Federation through the beginning of import substitution strategy, the discovery of new trading partners that are less likely to be a threat to trade, the adoption of the MIR payment system, the creation of the SPFS¹²³ network, *et cetera*. It also inadvertently protected Russia's petroleum industry from the Brent oil price collapse. This thesis demonstrated that many countries violate the Russian embargo. The trade of three potential gateway countries was observed, leading to the fact that Ukraine has the highest value of under-embargo imports from the EU, while Belarus is surprisingly low.

Since 2014, the diplomatic and geopolitical situation remains unchanged. Russian-European relations deteriorate more and more. Many economic actors are held hostage, and peoples' friendship is threatened. What I understood through the study of economic sanctions is that I sincerely and honestly believe that they shall not be used, and thus in any situation. They are powerless and only good to create economic disruption, which is dangerous for the stability of the economic order –as defined by F.A Hayek. In a more disturbing manner, they are also a threat to freedom and human rights –as the right to health, which rises several philosophical concerns.

As I finish this thesis, I am writing with the strange feeling that the end of this three-year research is rather the beginning.

¹²³ An alternative to the SWIFT network.

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Annexes

TABLE I-5 USED DATABASES

<i>Name</i>	<i>Flow</i>	<i>Details</i>	<i>Product</i>	<i>From</i>	<i>Until</i>	<i>Frequency</i>	<i>Indicator</i>	<i>Data Source</i>	<i>Extracted on**</i>	<i>Last Update***</i>
EU_RU_MVT_y	Import	EU28 from RU	Total SITC	2000	2019	Yearly	Value €	Eurostat - [DS-018995]	18.02.20	14.02.20
EU_RU_XVT_y	Export	EU28 to RU	Total SITC	2000	2019	Yearly	Value €	Eurostat - [DS-018995]	18.02.20	14.02.20
EU_WO_MVT_y	Import	EU28 from WO	Total SITC	2009	2018	Yearly	Value m€	Eurostat - [ext_lt_intertrd]	16.03.20	24.02.20
EU_WO_XVT_y	Export	EU28 to WO	Total SITC	2009	2018	Yearly	Value m€	Eurostat - [ext_lt_intertrd]	16.03.20	24.02.20
EU_RU_MVTss_m	Import	EU28 from RU	Under-Embargo	2000m1	2019m12	Monthly	Value €	Eurostat - [DS-018995]	07.03.20	14.02.20
EU_RU_XVTss_m	Export	EU28 to RU	Under-Embargo	2000m1	2019m12	Monthly	Value €	Eurostat - [DS-018995]	07.03.20	14.02.20
EU_RU_MVTtoe_y	Import	EU28 from RU	Out of Embargo	2000	2019	Yearly	Value €	Eurostat - [DS-018995]	18.02.20	14.02.20
EU_RU_XVTtoe_y	Export	EU28 to RU	Out of Embargo	2000	2019	Yearly	Value €	Eurostat - [DS-018995]	18.02.20	14.02.20
EU_RU_MVTw_m	Import	EU28 from RU	Total SITC	2009m5	2014m8	Monthly	Value €	Eurostat - [DS-018995]	17.02.20	14.02.20
EU_RU_XVTw_m	Export	EU28 to RU	Total SITC	2009m5	2014m8	Monthly	Value €	Eurostat - [DS-018995]	17.02.20	14.02.20
EU_RU_MVTt_m	Import	EU28 from RU	Total SITC	2014m9	2019m12	Monthly	Value €	Eurostat - [DS-018995]	17.02.20	14.02.20
EU_RU_XVTt_m	Export	EU28 to RU	Total SITC	2014m9	2019m12	Monthly	Value €	Eurostat - [DS-018995]	17.02.20	14.02.20
T10_RU_MV_y	Import	T10 to RU	Total SITC	2000	2019	Yearly	Value €	Eurostat - [DS-018995]	18.02.20	14.02.20
T10_RU_XV_y	Export	T10 to RU	Total SITC	2000	2019	Yearly	Value €	Eurostat - [DS-018995]	18.02.20	14.02.20
T10_RU_MV0-9_y	Import	T10 to RU	SITC 0 to 9	2009m5	2019m12	Yearly	Value €	Eurostat - [DS-018995]	18.02.20	14.02.20
T10_RU_XV0-9_y	Export	T10 to RU	SITC 0 to 9	2009m5	2019m12	Yearly	Value €	Eurostat - [DS-018995]	18.02.20	14.02.20
EU_RU_MV0-9_y	Import	EU28 from RU	SITC 0 to 9	2000	2019	Yearly	Value €	Eurostat - [DS-018995]	18.02.20	14.02.20
EU_RU_XV09-9_y	Export	EU28 to RU	SITC 0 to 9	2000	2019	Yearly	Value €	Eurostat - [DS-018995]	18.02.20	14.02.20

*EU28 stands for each country of the EU (28 members) treated separately, not as a sum of the 28. Similar logic for T10 that regroups the ten greatest European exporter to Russia.

Extraction date from Eurostat website ; *Last update of the database (made by Eurostat)

TABLE I-13
EXPORTS TO RUSSIA (VALUE IN €) PER COUNTRY, SITC SECTION AND PERIOD

<i>BE</i>	<i>CZ</i>	<i>DE</i>	<i>FI</i>	<i>FR</i>	<i>GB</i>	<i>IT</i>	<i>LT</i>	<i>NL</i>	<i>PO</i>	<i>SITC</i>
W 2 106 332 210	270 857 362	6 794 666 752	1 806 129 002	2 257 986 889	616 281 151	1 885 351 005	4 405 788 391	4 620 194 980	4 549 660 502	0
T 917 260 714	383 378 520	3 838 391 549	562 050 630	1 090 508 178	461 037 029	1 513 569 944	1 052 071 265	2 708 256 253	2 245 385 102	
W 354 426 372	106 664 027	822 519 653	136 875 775	768 339 551	260 715 284	822 786 048	786 079 469	113 799 781	68 644 623	1
T 741 286 446	114 099 410	737 916 553	71 509 883	452 153 389	223 210 094	843 874 426	1 101 088 382	188 135 562	74 872 102	
W 307 354 910	83 547 642	1 098 825 272	936 805 109	434 579 375	101 721 769	206 951 105	392 750 618	2 292 270 198	233 282 766	2
T 275 284 460	129 485 545	1 170 593 958	410 398 997	454 826 568	61 008 166	224 986 255	735 481 149	1 942 794 655	428 800 876	
W 793 231 083	46 858 475	1 062 647 893	1 426 120 966	104 054 044	274 784 127	91 526 854	114 928 916	318 096 262	312 201 342	3
T 603 479 515	47 601 679	676 506 939	935 998 366	110 749 332	67 224 637	103 307 441	85 112 021	218 741 916	185 862 359	
W 78 313 094	954 726	618 989 062	21 379 959	129 457 740	3 796 899	177 928 399	43 292 522	443 331 367	61 550 292	4
T 6 690 076	712 203	77 482 032	5 861 005	6 614 112	954 771	158 170 528	35 106 058	222 839 367	36 309 430	
W 9 068 451 389	1 846 111 540	25 739 939 603	5 266 098 455	10 353 357 588	4 277 785 252	3 940 911 004	1 549 249 064	5 123 963 495	5 433 054 687	5
T 9 170 548 389	1 555 680 540	26 383 058 318	3 025 692 817	9 302 233 588	3 494 128 884	5 242 547 793	3 080 451 753	6 292 138 239	6 943 293 486	
W 2 408 128 300	1 966 746 752	16 901 685 624	4 882 235 288	2 456 296 501	1 494 728 041	6 167 733 552	2 199 525 319	1 868 798 875	6 542 589 731	6
T 1 773 547 176	1 926 487 065	12 703 740 772	3 866 119 707	1 852 865 544	883 158 148	4 595 646 128	2 412 853 914	1 523 451 572	6 196 138 232	
W 5 956 078 260	13 456 439 562	92 212 385 402	9 275 020 082	18 133 872 028	12 931 936 875	19 286 717 570	6 687 234 734	18 347 432 925	12 377 519 398	7
T 4 424 264 243	11 240 123 031	68 252 433 112	7 128 497 713	12 308 617 304	9 318 822 647	15 827 374 589	7 769 789 842	13 093 504 808	12 534 113 077	
W 1 702 916 561	1 770 178 884	18 119 443 685	2 177 519 207	3 574 001 581	2 827 205 711	15 890 940 082	3 260 810 789	2 824 723 753	4 439 940 082	8
T 1 464 115 590	1 983 412 172	14 343 795 265	1 361 059 210	2 588 689 573	2 102 244 935	11 766 742 963	3 626 785 963	3 764 323 800	4 389 158 636	
W 167 655 215	42 370	4 268 401 714	2 994 439	120 141 315	136 831 168	9 140 978	3 071 040	9 346 653	7 115 264	9
T 396 030 390	319 790	3 185 363 979	1 288 620	18 794 333	91 203 463	68 495 271	4 545 481	7 779 845	5 988 824	

Data Source: Eurostat

TABLE I-14
RANKING - GREATEST EXPORTERS TO RUSSIA (EU28 COUNTRIES)

<i>Country</i>	<i>W</i>	<i>T</i>
EU28	100%	100%
DE	30.49%	29.61%
IT	8.80%	9.14%
FR	7.01%	6.41%
NL	6.67%	7.00%
PO	6.18%	7.47%
FI	4.87%	4.10%
GB	4.19%	3.79%
BE	4.17%	4.47%
CZ	3.55%	3.94%
LT	3.53%	4.51%
AT	3.44%	2.86%
SE	2.38%	2.25%
HU	2.38%	1.95%
ES	2.37%	2.27%
SK	2.11%	1.84%
LV	1.44%	1.96%
DK	1.36%	1.00%
EE	1.14%	1.04%
RO	1.02%	1.27%
SI	0.96%	1.04%
IE	0.50%	0.57%
BG	0.48%	0.59%
GR	0.36%	0.28%
HR	0.23%	0.22%
LU	0.17%	0.17%
PT	0.17%	0.21%
CY	0.02%	0.04%
MT	0.01%	0.00%

Data source: Eurostat

TABLE I-15
GREATEST DECREASE IN VALUE
(TOTAL EXPORTS TO RUSSIA)

<i>Country</i>	<i>Difference (m€)</i>
DE	- 37 809.94
FR	- 10 433.94
FI	- 8 831.38
IT	- 8 296.18
GB	- 6 442.31
NL	- 5 965.56
BE	- 3 335.26
CZ	- 2 247.12
PO	- 1 191.90
LT	+ 397.95

Data source: Eurostat

TABLE I-16
GREATEST DECREASE IN %
(TOTAL EXPORTS TO RUSSIA)

<i>Country</i>	<i>Difference (%)</i>
FI	-32.8%
GB	-27.8%
FR	-26.9%
DE	-22.4%
IT	-17.1%
NL	-16.2%
BE	-14.5%
CZ	-11.4%
PO	-3.5%
LT	2.0%

Data source: Eurostat

TABLE I-17
EMBARGO VIOLATORS RANKING

<i>Country</i>	<i>Value in m€</i>	<i>Rank</i>
EU28	1609.854531	-
NL	441.943796	1
LT	328.828112	2
DK	290.572592	3
BE	140.871689	4
DE	119.727727	5
IE	93.910007	6
PO	41.822728	7
FI	33.092363	8
GB	31.861574	9
LV	23.084153	10
FR	22.561087	11
IT	19.863647	12
EE	5.260412	13
AT	4.595651	14
CZ	3.605744	15
BG	3.201002	16
ES	2.97008	17
HU	0.897122	18
RO	0.43214	19
HR	0.261256	20
GR	0.156186	21
CY	0.086924	22
SE	0.070731	23
SI	0.054295	24
SK	0.052952	25
LU	0.04104	26
PT	0.029521	27
MT	0	28

Data source: Eurostat

TABLE I-18
SHARE OF TOTAL EXPORTS TO RUSSIA
IN TOTAL EXPORTS TO THE WORLD

<i>Country</i>	<i>W</i>	<i>T</i>	<i>Difference</i>
LT	18.14%	9.10%	-9.05 pp
FI	9.30%	2.39%	-6.91 pp
PO	4.68%	3.63%	-1.05 pp
CZ	3.25%	0.87%	-2.38 pp
DE	3.08%	2.42%	-0.66 pp
IT	2.49%	2.13%	-0.36 pp
FR	1.74%	1.39%	-0.35 pp
NL	1.47%	1.18%	-0.30 pp
BE	1.31%	1.20%	-0.11 pp
GB	1.24%	0.76%	-0.47 pp

Data source: Eurostat

TABLE I-19
SHARE OF EXPORTS OF UNDER-EMBARGO
PRODUCTS IN TOTAL EXPORTS TO RUSSIA

<i>Country</i>	<i>W</i>	<i>T</i>	<i>Difference</i>
LT	19.226%	1.652%	-17.57 pp
PO	7.447%	0.127%	-7.32 pp
BE	4.826%	0.715%	-4.11 pp
NL	4.773%	1.431%	-3.34 pp
FI	4.610%	0.183%	-4.43 pp
FR	1.682%	0.080%	-1.60 pp
IT	1.465%	0.049%	-1.42 pp
GB	1.116%	0.190%	-0.93 pp
DE	0.990%	0.092%	-0.90 pp
CZ	0.170%	0.021%	-0.15 pp

Data source: Eurostat

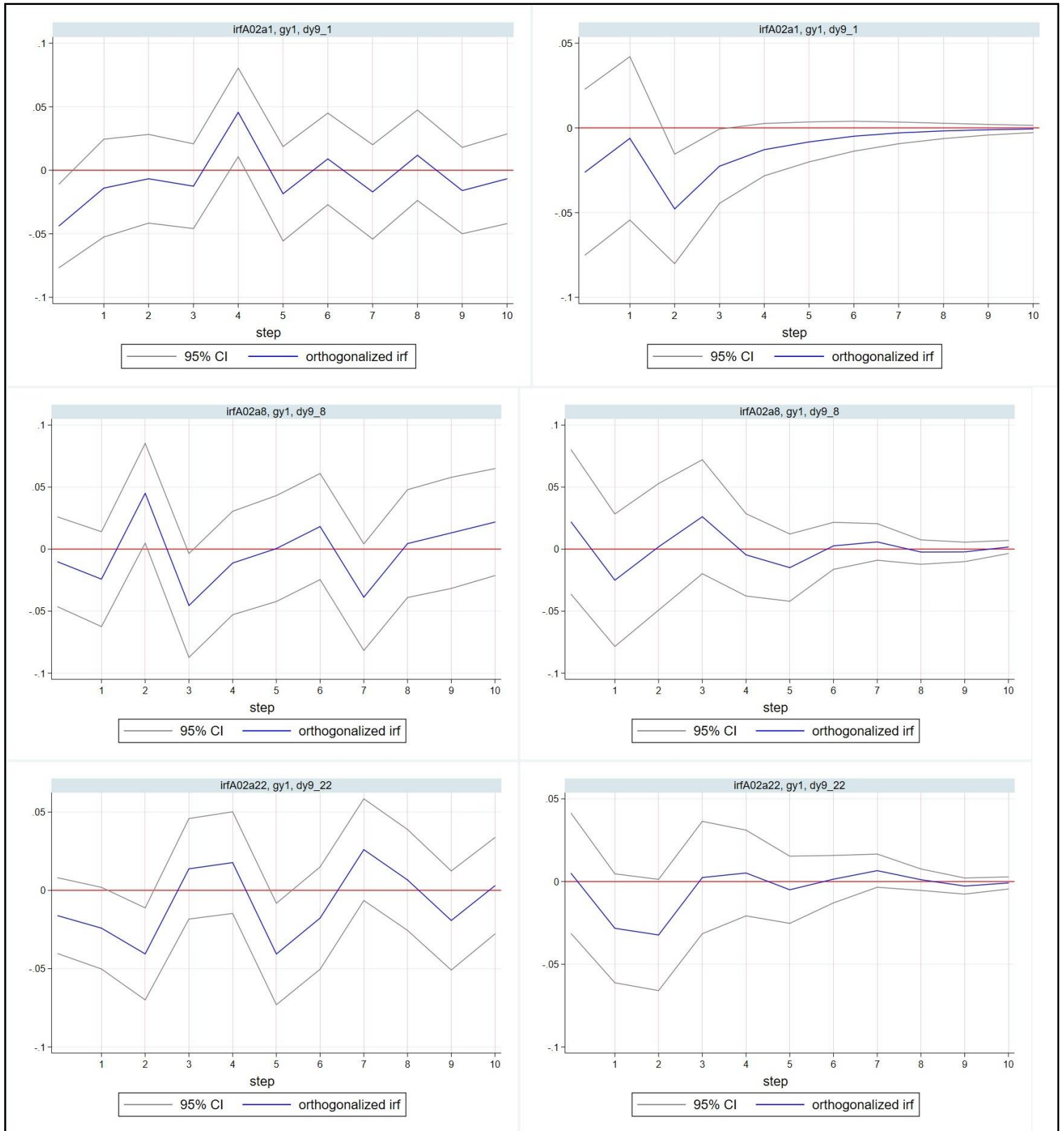
TABLE I-25
EU28 EXPORTS OF UNDER-EMBARGO GOODS TO BELARUS (M€), SUBSECTIONS

<i>Year</i>	<i>011</i>	<i>012</i>	<i>016</i>	<i>017</i>	<i>022</i>	<i>023</i>	<i>024</i>	<i>034</i>	<i>035</i>	<i>036</i>	<i>054</i>	<i>056</i>	<i>057</i>	<i>058</i>	<i>098</i>	<i>112</i>	<i>Total</i>
2009	0.13	30.14	0.03	0.00	0.40	0.01	1.33	8.49	0.62	1.78	6.15	0.02	34.55	0.42	0.30	0.10	84.46
2010	0.86	124.95	0.06	0.03	1.05	0.01	2.94	14.34	0.32	3.47	22.94	0.03	73.04	1.31	0.59	0.35	246.31
2011	4.99	189.58	0.05	0.03	0.35	0.02	1.12	11.29	0.03	2.25	49.56	0.01	85.67	1.47	0.45	0.21	347.09
2012	4.51	255.92	0.92	0.22	0.44	0.06	2.32	14.09	0.02	2.07	42.95	0.01	136.66	1.67	0.53	0.09	462.48
2013	3.11	184.32	0.41	1.15	2.35	0.04	3.99	15.74	0.05	1.88	98.80	0.03	201.27	1.31	0.82	0.37	515.63
2014	6.26	24.58	0.15	0.76	38.14	0.03	12.62	16.92	1.63	0.66	125.69	0.17	294.29	4.57	1.49	0.74	528.70
2015	2.50	8.06	0.00	0.15	19.78	0.05	7.18	26.36	0.51	1.92	153.26	0.01	356.78	10.83	7.29	0.63	595.31
2016	1.05	9.36	0.00	0.18	33.61	0.27	4.89	27.87	1.39	0.78	113.58	0.02	306.42	5.46	6.31	0.49	511.68
2017	0.04	7.72	0.08	0.12	3.60	0.05	5.17	28.22	0.05	0.84	107.29	0.01	296.30	6.50	10.50	0.78	467.27
2018	0.03	24.33	0.17	0.17	0.52	0.01	6.74	27.27	0.05	1.21	91.16	0.01	184.68	16.08	8.50	1.06	361.99
2019	0.74	14.04	0.48	0.22	0.58	0.00	8.33	26.89	0.10	1.14	93.11	0.03	181.03	22.70	5.36	1.67	356.42
Total	24.23	873.01	2.36	3.02	100.82	0.55	56.63	217.48	4.77	17.99	904.49	0.36	2150.66	72.33	42.15	6.48	4477.33

TABLE II-S
SANCTION INDEX

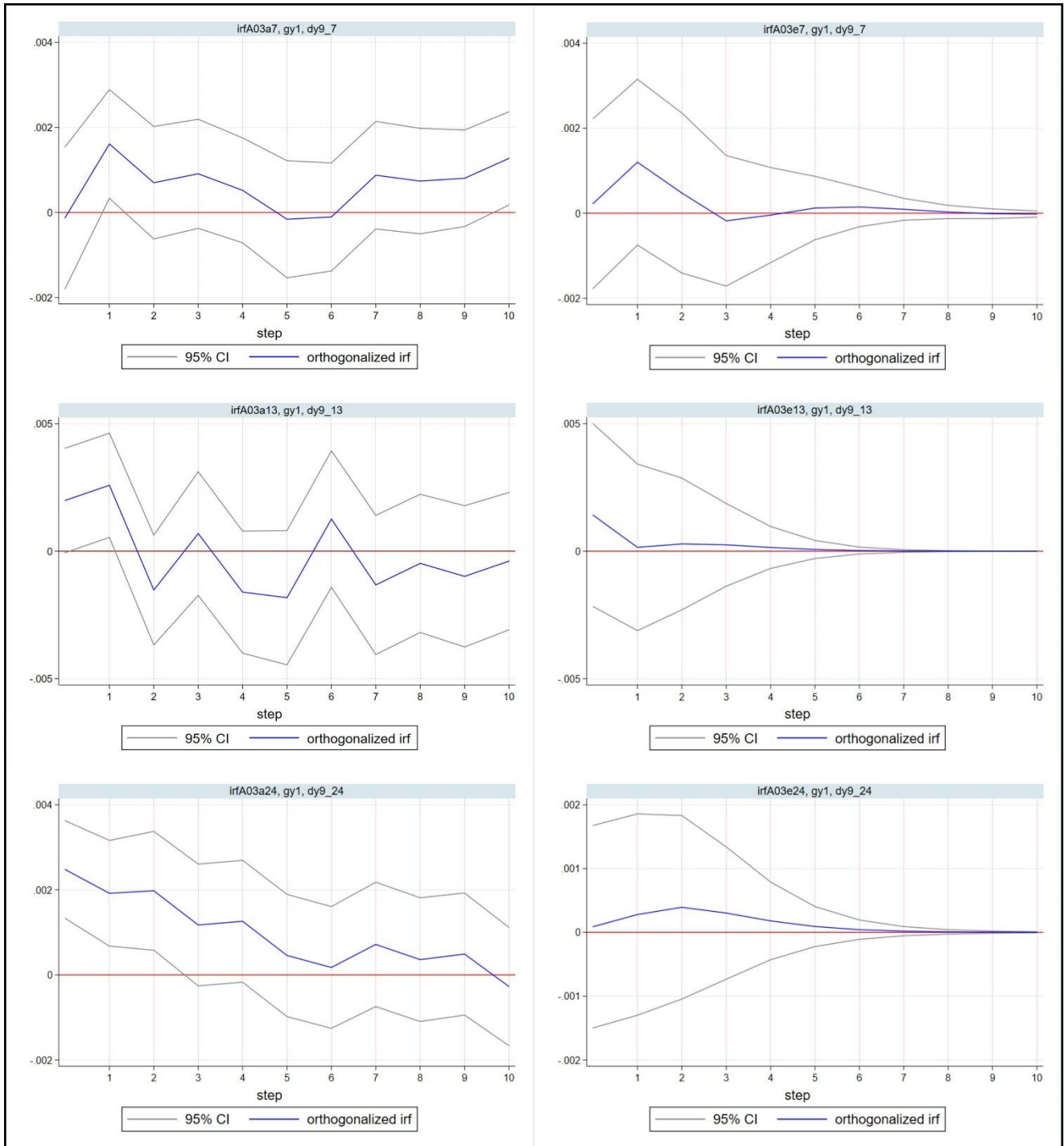
<i>Date</i>	<i>Sanction Index</i>	<i>Date</i>	<i>Sanction Index</i>
01/01/2003	0	01/07/2011	0
01/04/2003	0	01/10/2011	0
01/07/2003	0	01/01/2012	0
01/10/2003	0	01/04/2012	0
01/01/2004	0	01/07/2012	0
01/04/2004	0	01/10/2012	0
01/07/2004	0	01/01/2013	0
01/10/2004	0	01/04/2013	0
01/01/2005	0	01/07/2013	0
01/04/2005	0	01/10/2013	0
01/07/2005	0	01/01/2014	0.782207549
01/10/2005	0	01/04/2014	13.99554729
01/01/2006	0	01/07/2014	229.8978577
01/04/2006	0	01/10/2014	302.4445801
01/07/2006	0	01/01/2015	375.6568604
01/10/2006	0	01/04/2015	254.4457703
01/01/2007	0	01/07/2015	183.9444733
01/04/2007	0	01/10/2015	137.5222931
01/07/2007	0	01/01/2016	114.2431107
01/10/2007	0	01/04/2016	76.11917877
01/01/2008	0	01/07/2016	48.28166199
01/04/2008	0	01/10/2016	36.55220032
01/07/2008	0	01/01/2017	30.10864639
01/10/2008	0	01/04/2017	16.73850441
01/01/2009	0	01/07/2017	10.12082577
01/04/2009	0	01/10/2017	6.752026081
01/07/2009	0	01/01/2018	4.859596252
01/10/2009	0	01/04/2018	2.719523907
01/01/2010	0	01/07/2018	1.632797837
01/04/2010	0	01/10/2018	0.831875384
01/07/2010	0	01/01/2019	0.683202207
01/10/2010	0	01/04/2019	0.432903588
01/01/2011	0	01/07/2019	0.208868131
01/04/2011	0	01/10/2019	0.208868131

GRAPH III-2 COMPARISON AIC VS HQIC



Note: On the left are IRFs from models using a lag number obtained from AIC test, while on the right are IRF from models using a lag number provided by HQIC.

**GRAPH III-4
COMPARISON AIC vs HQIC**



Note: On the left are IRFs from models using a lag number obtained from AIC test, while on the right are IRF from models using a lag number provided by HQIC.

GRAPH III-5 COMPARISON AIC VS HQIC

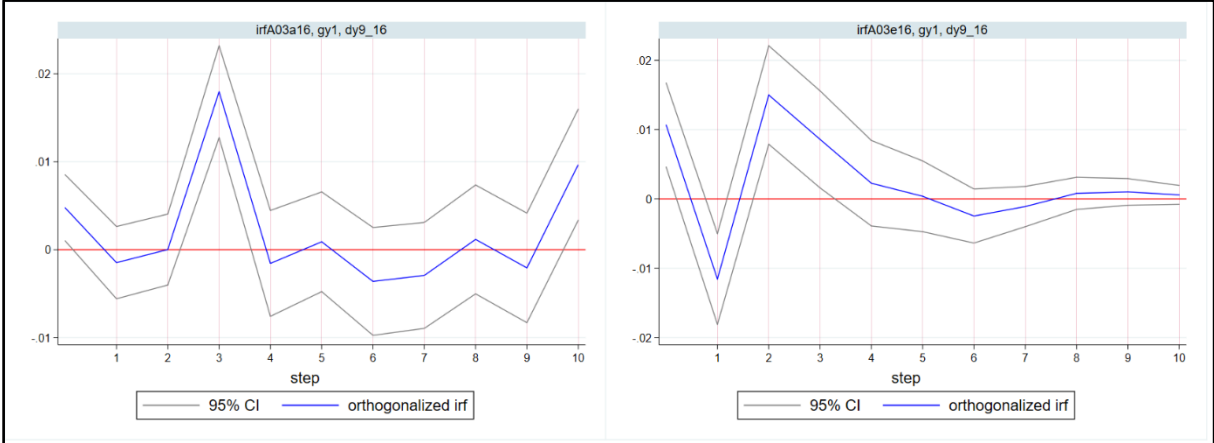


TABLE III-4
OPTIMAL LAG ORDER (A01)

<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>	<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>
1	AT - Austria	8	AIC & HQIC & SBIC	15	HU - Hungary	8	AIC & HQIC & SBIC
2	BE - Belgium	8	AIC & HQIC & SBIC	16	IE - Ireland	8	AIC & HQIC & SBIC
3	BG - Bulgaria	8	AIC & HQIC & SBIC	17	IT - Italy	8	AIC & HQIC & SBIC
4	CY - Cyprus	7	*	18	LT - Lithuania	8	AIC & HQIC & SBIC
5	CZ - The Czech Republic	8	AIC & HQIC & SBIC	19	LU - Luxembourg	8	AIC & HQIC & SBIC
6	DE - Germany	8	AIC & HQIC & SBIC	20	LV - Latvia	8	AIC & HQIC & SBIC
7	DK - Denmark	8	AIC & HQIC & SBIC	21	MT - Malta	8	AIC & HQIC & SBIC
8	EE - Estonia	8	AIC & HQIC & SBIC	22	NL - Netherlands	7	AIC & HQIC & SBIC
9	ES - Spain	8	AIC & HQIC & SBIC	23	PO - Poland	8	AIC & HQIC & SBIC
10	FI - Finland	8	AIC & HQIC & SBIC	24	PT - Portugal	7	AIC & HQIC & SBIC
11	FR - France	7	AIC & HQIC & SBIC	25	RO - Romania	8	AIC & HQIC & SBIC
12	GB - United Kingdom	8	AIC & HQIC & SBIC	26	SE - Sweden	8	AIC & HQIC
13	GR - Greece	8	AIC & HQIC & SBIC	27	SI - Slovenia	7	AIC & HQIC & SBIC
14	HR - Croatia	8	AIC & HQIC & SBIC	28	SK - Slovakia	7	AIC & HQIC & SBIC

*Note: *Model 4 showed more consistent results with 7 lags. Thus, it has been decided to keep 7 lags instead of 8, as indicated by AIC, HQIC, and SBIC.*

TABLE III-7
OPTIMAL LAG ORDER (A01A)

<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>	<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>
1	AT - Austria	2	SBIC	15	HU - Hungary	3	AIC & FPE
2	BE - Belgium	8	AIC	16	IE - Ireland	8	AIC
3	BG - Bulgaria	2	AIC	17	IT - Italy	8	AIC & FPE
4	CY - Cyprus	8	AIC	18	LT - Lithuania	4	AIC & FPE
5	CZ - The Czech Republic	8	AIC	19	LU - Luxembourg	8	AIC
6	DE - Germany	8	AIC	20	LV - Latvia	8	AIC
7	DK - Denmark	3	AIC & FPE	21	MT - Malta	4	FPE & AIC & HQIC
8	EE - Estonia	8	AIC	22	NL - Netherlands	8	FPE & AIC & HQIC
9	ES - Spain	8	AIC & FPE	23	PO - Poland	2	FPE & AIC & HQIC
10	FI - Finland	8	FPE & AIC & HQIC	24	PT - Portugal	8	AIC
11	FR - France	8	AIC & FPE	25	RO - Romania	3	AIC & FPE
12	GB - United Kingdom	8	AIC	26	SE - Sweden	8	AIC & FPE
13	GR - Greece	8	AIC	27	SI - Slovenia	2	HQIC & SBIC
14	HR - Croatia	8	AIC	28	SK - Slovakia	2	AIC & HQIC

TABLE III-13
OPTIMAL LAG ORDER (A02)

<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>	<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>
1	AT - Austria	8	AIC & HQIC	15	HU - Hungary	7	AIC & HQIC & SBIC
2	BE - Belgium	7	AIC & HQIC & SBIC	16	IE - Ireland	7	AIC & HQIC & SBIC
3	BG - Bulgaria	7	AIC & HQIC & SBIC	17	IT - Italy	7	HQIC & SBIC
4	CY - Cyprus	8	AIC & HQIC	18	LT - Lithuania	7	AIC & HQIC & SBIC
5	CZ - The Czech Republic	7	AIC & HQIC & SBIC	19	LU - Luxembourg	7	AIC & HQIC & SBIC
6	DE - Germany	8	AIC & HQIC & SBIC	20	LV - Latvia	7	HQIC & SBIC
7	DK - Denmark	8	AIC & HQIC & SBIC	21	MT - Malta	8	AIC & HQIC
8	EE - Estonia	7	HQIC & SBIC	22	NL - Netherlands	7	AIC & HQIC & SBIC
9	ES - Spain	8	AIC & HQIC & SBIC	23	PO - Poland	7	AIC & HQIC & SBIC
10	FI - Finland	8	AIC & HQIC	24	PT - Portugal	8	AIC & HQIC
11	FR - France	7	AIC & HQIC & SBIC	25	RO - Romania	7	HQIC & SBIC
12	GB - United Kingdom	8	AIC & HQIC & SBIC	26	SE - Sweden	7	HQIC & SBIC
13	GR - Greece	7	AIC & HQIC & SBIC	27	SI - Slovenia	7	HQIC & SBIC
14	HR - Croatia	8	AIC & HQIC	28	SK - Slovakia	7	AIC & HQIC & SBIC

TABLE III-16
OPTIMAL LAG ORDER (A02A)

<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>	<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>
1	AT - Austria	8	AIC	15	HU - Hungary	8	AIC
2	BE - Belgium	8	AIC	16	IE - Ireland	8	AIC
3	BG - Bulgaria	8	AIC	17	IT - Italy	8	AIC
4	CY - Cyprus	8	AIC	18	LT - Lithuania	3	AIC
5	CZ - The Czech Republic	8	AIC	19	LU - Luxembourg	2	AIC
6	DE - Germany	3	AIC	20	LV - Latvia	6	AIC
7	DK - Denmark	8	AIC	21	MT - Malta	8	AIC
8	EE - Estonia	8	AIC	22	NL - Netherlands	8	AIC
9	ES - Spain	1	AIC	23	PO - Poland	7	AIC
10	FI - Finland	8	AIC	24	PT - Portugal	3	AIC
11	FR - France	8	AIC	25	RO - Romania	6	AIC
12	GB - United Kingdom	8	AIC	26	SE - Sweden	3	AIC
13	GR - Greece	8	AIC	27	SI - Slovenia	3	AIC
14	HR - Croatia	8	AIC	28	SK - Slovakia	3	AIC

TABLE III-20
OPTIMAL LAG ORDER - (A03)

<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>	<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>
1	AT - Austria	8	AIC & HQIC & SBIC	15	HU - Hungary	8	AIC & HQIC
2	BE - Belgium	8	AIC & HQIC & SBIC	16	IE - Ireland	8	AIC & HQIC & SBIC
3	BG - Bulgaria	8	AIC & HQIC & SBIC	17	IT - Italy	8	AIC & HQIC & SBIC
4	CY - Cyprus	7	AIC & HQIC & SBIC	18	LT - Lithuania	7	AIC & HQIC & SBIC
5	CZ - The Czech Republic	8	AIC & HQIC & SBIC	19	LU - Luxembourg	7	AIC & HQIC & SBIC
6	DE - Germany	7	AIC & HQIC & SBIC	20	LV - Latvia	7	AIC & HQIC & SBIC
7	DK - Denmark	7	AIC & HQIC & SBIC	21	MT - Malta	7	AIC & HQIC & SBIC
8	EE - Estonia	7	AIC & HQIC & SBIC	22	NL - Netherlands	8	AIC & HQIC
9	ES - Spain	7	AIC & HQIC & SBIC	23	PO - Poland	7	AIC & HQIC & SBIC
10	FI - Finland	7	AIC & HQIC & SBIC	24	PT - Portugal	7	AIC & HQIC & SBIC
11	FR - France	7	AIC & HQIC & SBIC	25	RO - Romania	7	AIC & HQIC & SBIC
12	GB - United Kingdom	8	AIC & HQIC & SBIC	26	SE - Sweden	8	AIC & HQIC & SBIC
13	GR - Greece	7	AIC & HQIC & SBIC	27	SI - Slovenia	7	AIC & HQIC & SBIC
14	HR - Croatia	8	AIC & HQIC & SBIC	28	SK - Slovakia	8	AIC & HQIC

TABLE III-23
OPTIMAL LAG ORDER - (A03A)

<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>	<i>Model No.</i>	<i>Country</i>	<i>Lag</i>	<i>Information Criteria</i>
1	AT - Austria	8	AIC	15	HU - Hungary	8	AIC
2	BE - Belgium	8	AIC	16	IE - Ireland	8	AIC
3	BG - Bulgaria	8	AIC	17	IT - Italy	8	AIC
4	CY - Cyprus	8	AIC	18	LT - Lithuania	3	AIC
5	CZ - The Czech Republic	8	AIC	19	LU - Luxembourg	2	AIC
6	DE - Germany	3	AIC	20	LV - Latvia	6	AIC
7	DK - Denmark	8	AIC	21	MT - Malta	8	AIC
8	EE - Estonia	8	AIC	22	NL - Netherlands	8	AIC
9	ES - Spain	1	AIC	23	PO - Poland	7	AIC
10	FI - Finland	8	AIC	24	PT - Portugal	3	AIC
11	FR - France	8	AIC	25	RO - Romania	6	AIC
12	GB - United Kingdom	8	AIC	26	SE - Sweden	3	AIC
13	GR - Greece	8	AIC	27	SI - Slovenia	3	AIC
14	HR - Croatia	8	AIC	28	SK - Slovakia	3	AIC

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